Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LIV. NEW YORK, THURSDAY, SEPTEMBER 30, 1909. No. 14.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.
239 WEST THIRTY-NINTH STREET, NEW YORK.
TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....per year, 4.50
Other Foreign Countries within the Postal Union.....per year, 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1908, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

Copyright, 1909, by McGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1908 *was* 898,000. *Of this issue* 16,000 *copies are printed.*

NEW YORK, THURSDAY, SEPTEMBER 30, 1909.

CONTENTS.

Editorial 751
Niagara Falls Electric Power City Pumping Contract..... 754
Change in Chairmanship of Accounting Committee..... 754
Baltimore Electric Service Contract Controversy..... 754
Contract of Worcester (Mass.) Electric Light Company Sought..... 755
Edison Cement Plant Visited by Baltimoreans..... 755
Illinois Central Electrification Progress..... 755
New Interurban Railway Near Chicago..... 756
Boston Edison Company's Annual Report..... 756
Change in Boston Elevated Power System..... 757
Completion of Chicago Quarry Street Station..... 757
Edison Power Improving Trolley Service Near Boston..... 757
Development of a Suburban Electric Service System..... 758
Proposed Massachusetts Electric Railway Consolidation..... 759
Truckee River Water-Power Controversy..... 759
German-American Patent Treaty..... 759
Patent Litigation Procedure..... 759
Convention of Illuminating Engineering Society..... 760
Annual Meeting of the Rejuvenated Sons of Jove..... 763
New York Public Service Commission News..... 764
Massachusetts Commission News..... 764
Wisconsin Rate Commission..... 765
Current News and Notes..... 765
Wireless Telegraphy in the U. S. Navy..... 767
Test of Electromagnets. By C. P. Nachod..... 768
Niagara Energy in Buffalo..... 769
Hudson-Fulton Celebration in New York City..... 770
Some Casual Remarks on Dampeners. By Warren H. Miller..... 778
"Seeing Denver" Illumination. By C. H. Stannard..... 780
Wallingford (Conn.) Municipal Plant..... 781
Useful Figures from Practical Power-Plant Operation..... 781
Increasing Central-Station Profits at Geneva, Ill..... 782
Old-Time Wiring 783
Denver Theater Electrical Illumination..... 783
Industrial Plant Illumination with Tungstens. By Arthur Gillman.. 784
Wiring of High-Grade Apartment House. By N. M. Schoonmaker.. 785
New Telephone Patents..... 787
LETTERS TO THE EDITORS:
Movement of Magnetic Particles in a Rotating Field. By H. J. De Laak 788
The Atlantic Cable of 1858. By Charles Bright..... 788
Digest of Current Electrical Literature..... 791
New Apparatus and Appliances..... 795
Industrial and Commercial News..... 799
General News 803
Weekly Record of Electrical Patents..... 810

This is the last issue of *Electrical World* with which it will be my privilege to be associated as an editor of the journal; and on Oct. 1 I take up new duties as executive secretary of the National Electric Light Association. The severance of the relationship with the component papers, which has endured from before the first issue of *Electrical World* in 1883, is not made without deep regret. My connection with electrical journalism, dating back to its very beginnings, has given me the opportunity to aid in upbuilding the great modern arts and industries based on electrical energy, and to assist in developing certain ideals of public service. There never was a time when the loss of any individual personality could have less effect upon the standing of *Electrical World* as the great organ of electrical development in America. The paper has enjoyed the direction of many brilliant men, but its staff was never so large, so competent, so experienced as now; while the proprietors were never more jealous of the place won by this publication for impartiality, promptness, and representative contact with the entire field of readers and advertisers. Many who read this farewell know that from time to time flattering inducements have been addressed to me from other lines of occupation. Gratifying as they were, in none of them did I hear the call of duty until now; and in the service of the National Electric Light Association I can employ to the full whatever of constructive skill and driving power yet remain to me. The Association, about to enter on its second quarter century, has reached a point of splendid growth, where the care of its numerous membership and the study of its wide variety of industrial and corporate aspects might well appeal to any man's ambition. Bringing to bear upon these matters the experience given me on *Electrical World*, I hope to be worthy of the selection made. The many letters of goodwill that have reached me recently are hereby acknowledged with profound thanks as further evidences of the confidence of the leaders in the art, whose friendship toward the paper has ever been recognized as a valuable asset, and whose continued esteem I hope to merit in my new sphere of labor.

T. C. MARTIN.

THE END OF A WOULD-BE REFORM.

The so-called Daylight Saving Bill, which has been a source of international merriment for the past year or so, has again been turned down by the Parliamentary committee to which it had been solemnly referred. The similar effort in our own country has also been quite effectively buried and the chances are that the whole subject will be soon forgotten like many another queer scheme that has been brought forward by owlish

reformers. It is not, of course, the idea of utilizing daylight that amuses one, but the notion of legislating people out of their ordinary modes of life. It is like passing a law that everybody must get up at 5:30 a. m. and breakfast at 6:15 on near-cereal and bogus coffee. Anyone who wants to go in for daylight saving can do so now without any hindrance save that interposed by the Imperial Order of Kitchen Manipulators. An alarm clock can be purchased at anywhere from 99 cents to $1.37 which, if set upon an overturned tin pan, is guaranteed to arouse the ambitious Daylight Saver at dawn. He can then get his own breakfast, if the cook allows her kitchen to be disordered. This program should remove all danger of overeating. He can then take the first train to town, get into his building by a trivial bribe to the night watchman, climb 8 to 20 flights of stairs (capital exercise, this) and settle comfortably down to work in quiet if his is any ordinary professional career. There is not the slightest need of setting the clock ahead or struggling to get bills passed on the subject. Merely a little real individual initiative will turn the trick for anyone who feels that it is a sin to waste daylight. There is a small chance that the first experimenters would be run in as suspicious characters, but the police on the beat would soon come to know them and the reform could go on unimpeded.

Convention of the I. E. S.

From the report of the convention of the Illuminating Engineering Society, held in New York during the present week, as printed elsewhere in this issue, it will be noted that the papers and discussions proved to be of much interest and importance. The attendance at the sessions of this, the third, convention of the society was decreased rather than increased by the Hudson-Fulton celebration, with which it came in competition as an attraction for the members of the society. However, the registration of about 300 compares very favorably with that reported for many of the national bodies that have been in existence for a much longer period, and exceeds that of the recent Frontenac A. I. E. E. meeting. The program included a classic lecture by Dr. C. P. Steinmetz, together with 18 papers dealing with both the scientific and practical sides of illuminating engineering. Brief abstracts of these papers are to be found in this issue.

The profession must again record its debt to Mr. L. B. Marks for placing before the society much valuable practical data relating to illuminating engineering practice, while Dr. Louis Bell has rendered good service in giving a practical view of the types of shades and reflectors now in use. The paper by Mr. P. S. Millar calling attention to the confusion which exists in heterchromatic photometry justifies definite action in order to eliminate misunderstandings and misrepresentations when the merits of the various illuminants are discussed with reference to the color of the light produced. Glances into the past for ascertaining what to expect for the future are afforded in a paper by Dr. Angelo Simonini, while the imagination is carried along to the far distant future by a paper dealing with the light of the fire-fly presented by Drs. Ives and Coblentz. The fact that an output of 50 candles per watt is not theoretically beyond the range of possibility shows the immense improvements that may be introduced into present lighting methods wherein an output of one candle per watt is considered highly satisfactory.

Movement of Magnetic Particles in a Magnetic Field.

In our issue of July 22 last, Professor Boleman described, in a communication to the editors, on page 204, a remarkable phenomenon relating to the movement of iron filings, and of iron disks, in a certain rotating magnetic field. We commented upon the matter in our editorial columns at the time, and offered an explanation for the curious observed behavior of these iron particles, based on magnetic hysteresis. In a communication to the editors, which appeared in our issue of Sept. 9 (page 622), Prof. C. W. Lange took exception to this explanation, and offered instead one based upon pure magnetic tractive forces, although in a subsequent communication printed on page 729 of Sept. 23 Prof. Lange expanded his suggestion to cover magnetic tractive forces on poles created and displaced by the last preceding rotating field-pole, thus introducing at least the influence of magnetic history. In this number appears, on page 788, a communication on the same phenomena, by Prof. H. J. De Laak. This communication attributes the behavior of the iron filings to yet another action, namely, to couples exerted on "elongated bodies" or little prisms of iron. It is interesting to notice how different appear the explanations that different observers have thus far offered for these curious movements. In fact, the original communication of Professor Boleman suggested that iron filings could be represented on an enlarged scale by buttons, or that filings behaved like little iron disks, whereas the explanation of Professor De Laak is apparently based upon the virtual behavior of iron filings as rods or ellipsoids, as distinguished from disks or spherical particles.

It is evident that more experimental or mathematical evidence must be adduced on these phenomena before we can have a consensus of opinion. Possibly the actions involved are mixed and do not lie entirely along any one line of explanation. At all events, there is room for interesting research on what looks at first sight like a very simple question, namely, why filings scattered over a wooden plate move with the rotating field of a polyphase stator when the plate is below but against the rotating field when the plate is above.

If iron sphericles are substituted for iron filings, and the phenomena disappear, it might be inferred that Professor De Laak's explanation of elongated bodies is the clue to the action. If, on the contrary, the phenomena persist with spherical particles, or iron shot, then some other cause would be indicated. The actions of eddy currents have to be watched and eliminated in such an inquiry, because various kinds of mechanical forces may be set up, as is well known, by the electromagnetic cross-sections of rotating magnetic fields and the eddy currents they may create. Certain facts are at hand to define the starting-point of such an investigation. It will be generally conceded that, in Professor Boleman's originally described experiment, the friction of the buttons with the horizontal plate has a very prominent influence on their behavior, for with the plate above the stator, the buttons roll against the movement of the field, but when a button is suspended by a thread, so as to take its gravitational pressure off the plate, it goes round with the field. Again, the forces involved are to be magnetic, without sensible assistance from eddy currents. Finally, pure magnetic tractions must be distinguished, in some way, from tractions which are displaced by hysteretic action or by the lagging of polar axes in

the particles behind the rotating line of magnetizing force. We hope the matter will be investigated by some of our readers and reported upon at a later date.

DAMPERS FOR SYNCHRONOUS MACHINES.

The varous types of dampers that have been adopted or proposed for use with synchronous machines are interestingly discussed in an article by Mr. Warren H. Miller in this issue. While the performance of the squirrel-cage type of damper advocated by the author doubtless justifies his conclusions as to its merits, yet his course of reasoning appears to be at variance with the accepted electromagnetic relations applying. The implication that the m.m.f. of the wattless component of the armature current tends to distort the main field contradicts the well-established principle that it is the power component alone which causes distortion, the wattless component tending merely to increase or decrease the field magnetism. Moreover, it cannot be assumed that any damper can so act as to neutralize "the back ampere-turns due to strong armature reaction," for the reason that the only action of the damper is to oppose any rapid change in the flux which it surrounds, and this without any reference whatsoever to the absolute value of that flux, while the so-called "armature reaction" in a polyphase machine is the result of a m.m.f. of practically constant value and space-phase position.

During the normal operation of a generator at, say, 100 per cent power factor, and without hunting, the field-circuit m.m.f. tends to produce flux in line with the field poles, while the armature m.m.f. is directed along a line in electrical space-quadrature with the direction of the former m.m.f. The reluctance in line with the armature m.m.f. is relatively very high in comparison with that of the main magnetic circuit, so that very little flux is produced between the main field poles; the most pronounced result is a distortion, or shifting, of the main field flux across the pole faces. A change in the load on the generator without a variation in the power factor alters the amount of field distortion, while a change in the power factor of the load increases or decreases the actual value of the main field flux. During "hunting" there are rapid changes in both the power factor and the load. The so-called grid type of damper, being in such a position that opposing currents are produced in it by either a rapid shifting of the field flux or change in its value, tends to prevent any rapid change in the value or power factor of the load, and hence is of assistance in preventing hunting. When end-rings, or the equivalent, are used to interconnect the grid dampers on adjacent field poles, the damping effect is increased by reason of the currents produced in the end-ring circuits by the rapid change in the value of the magnetism between the field poles. As noted above, the reluctance of the path for this magnetism is relatively very high, so that the flux is small in value and the currents produced thereby are correspondingly weak. However, to the extent that any currents are produced in the end-ring circuits, their effect is exerted in the proper direction to prevent hunting. The combination of the end-rings with the grid dampers results in the squirrel-cage type of damper, which may well be considered somewhat more effective than the grid type, as pointed out by Mr. Miller. However, the advantage of the squirrel-cage type can be lost by an improper design of the circuits or can be overcome by the use of extra conductivity with the grid type.

THE KAPP-HOPKINSON TEST ON A SINGLE DIRECT-CURRENT MACHINE.

The August number of the *Journal* of the (British) Institution of Electrical Engineers contains a paper, by Dr. W. Lulofs, on the extension of the Hopkinson circulation of power test to a single direct-current machine. Hopkinson in 1886 brought out the method of measuring the efficiency of two similar machines by connecting them both mechanically and electrically, in such a manner that their two rotors formed a single joint rotor, one machine being over-excited to act as generator, while the other was under-excited to act as motor. The system was then driven mechanically by a small auxiliary prime-mover that mechanically supplied the joint power losses—that is, the losses were supplied through a transmission dynamometer. The generator could thus be operated at rated load on the motor, which was also operated at rated load, while the auxiliary power consumed might be from 30 to 10 per cent of the rated load according to the size of the machines. Later on, a test-motor, whose behavior was independently known, was substituted for the transmission dynamometer, and in this form the test is well known to-day. Kapp introduced, in 1890, the further simplification that the auxiliary machine supplying the power losses could be a generator instead of a motor, in which case all the powers measured were in terms of volts and amperes. More recently, the Hopkinson method has been applied to the testing of a single alternator by Behrend and Mordey, the windings of one and the same machine being divided into two groups having respective motor and generator characteristics, with the result that rated-load current could be supplied through the armature winding, while only the rated-load losses had to be supplied to the machine.

In the present paper, Dr. Lulofs takes a multipolar direct-current machine with a lap-wound multiple-path armature devoid of equalizing connections, and separates the positive and negative brushes into two groups, so as to make half of the armature act as a generator and the other half act as a motor. The required difference of behavior between the two armature portions is obtained by giving some of the field poles a preponderance of excitation over others. Certain precautions have to be taken to offset and allow for armature reaction and spurious losses due to power-circulation in armature coils. The method is ingenious, but appears to be rather complicated. Its limitations to multipolar machines capable of being divided up into two opposing halves are serious. For example, the method does not appear to be applicable to wave-wound or to series-connected armatures, to cross-connected armatures, or to bipolar armatures. Whatever the practical limitations of the method may be, it seems to complete the series of Hopkinson tests, which now embrace not only pairs of direct or alternatory-current machines, including converters and transformers, but also single machines of each class, whenever the single machine permits of being divided against itself. In matters of statesmanship, the proverb has been "divide and govern"; but in matters Hopkinsonian, the proverb becomes "divide and load." There is something fascinating in the spectacle of two large machines, tied together Hopkinsonically, running under full load with the aid of a mere pigmy machine to keep them going. It is perhaps the nearest parallel to a man lifting himself by his own boot-straps that electrical machinery furnishes.

Niagara Falls Electric Power City Pumping Contract.

Last week a brief note was made of the recent contract between the city of Niagara Falls and the Niagara Falls Hydraulic Power Company for the supply of electric power for city pumping purposes. Below are given further details, which also account for the low rate under the contract for power, namely, $9 and $10 hp-year.

According to the contract the city transfers and releases to the Hydraulic Company all its power and water rights under two agreements, one dated Sept. 1, 1878, and the other dated Dec. 12, 1906. The first-mentioned agreement provided that the city may take and use water from the hydraulic canal for the purpose of developing power for the operation of the present pumping station, upon the lands upon which such station is located, for a period of 99 years, with the exception of 40 hp, the lease for which is for a period of 99 years from the first day of January, 1886. This water-power was to be furnished at $10 per horse-power per annum. The agreement of Dec. 12, 1906, is a lease of electric horse-power for the operation of the electrical power pumps at the present pumping station, at an annual rental of $16 per horse-power.

In consideration of the city releasing its power and water rights, the Hydraulic Company now agrees to furnish power for the operation of the new pumping station until Jan. 31, 1984, at the following terms and prices:

Eight hundred horse-power continuously at $9 per horse-power per annum. Fifteen hundred additional continuous horse-power as the same may be called for by the city, in blocks of not less than 50 hp at $10 per horse-power per annum. Emergency power, which is to be furnished only in the contingencies of fire, fire drills conducted by members of the fire department, or tests of water mains, fire hydrants, pumps, pumping station and electrical apparatus, to an amount equal to continuous power then being used and paid for by the city, at the rate of $10 per horse-power per annum. Power used in excess of the amount of continuous power purchased and paid for at any time by the city, which is designated "optional power," to be at the rate of $16 per horse-power per annum. Neither emergency power nor excess power is to be paid for unless the same is used continuously for a period of 10 minutes or more.

It is provided that in case any tax, fee, rental or charge shall be levied, assessed or imposed by Federal, State or other Governmental authority upon the development, generation, sale or transmission of power or the right thereto of said company, such proportion of such tax, rental or charge, as the amount of continuous power then being purchased and paid for by the city, bears to the total amount of power developed by the Hydraulic Company, shall be added to the price of continuous power and paid by the city as a part thereof.

The city also agrees to maintain its mains in the private right-of-way along the hydraulic canal basin during the term of this contract, and to allow the Hydraulic Company and its tenants on the canal basin the use of water for the purposes of protection against fire, without charges, as specified in an agreement between the city and the Hydraulic Company and its tenants, dated Oct. 30, 1894, which agreement is continued in force until Dec. 31, 1984.

The city also agrees to supply water to the private water-pumping system maintained by the Hydraulic Company having a rated capacity of 200 gal. per minute, in case of accident or temporary shut-down of such private system, without charge, up to 5,000,000 in any calendar year, beginning Jan. 1, 1910, and at usual rates for any excess over said amount in any calendar year.

The city agrees to construct and maintain all apparatus, cables and machinery necessary to take electrical power from the point of delivery to the premises where the city shall use the same. The contract provides for arbitration in the event of disputes or misunderstandings between the parties. Finally, the premises on which the present pumping station is located is to be transferred to the Hydraulic Company for the sum of $20,000.

As will be seen from the foregoing, the contract gives valuable considerations to the Hydraulic Company in return for the low rate for power accorded.

Change in Chairmanship of Accounting Committee.

Mr. H. M. Edwards, auditor of the New York Edison Company, has resigned as chairman of the accounting committee of the National Electric Light Association and is succeeded in this position by Mr. John L. Bailey, treasurer of the Consolidated Gas, Electric Light & Power Company, of Baltimore. Mr. Edwards withdrew from the office of chairman because of the pressure of other duties and the feeling that he had devoted three years to the position and also because of a desire that others should be active in the work; he continues, however, as a member of the committee.

Under the chairmanship of Mr. Edwards the committee presented reports at the Washington, Chicago and Atlantic City conventions, held during the years 1907 to 1909 inclusive. There had not been a committee for several years previously to consider the accounting problems, and meager attention had been paid in the proceedings to questions of this nature. At the 1908 convention the committee presented a classification of operating accounts, which is the standard classification of the association. A classification of capital accounts was presented at the 1909 convention and has since been adopted by the executive committee. Permanent organization for the accountants has been effected by the creation of an accounting section of the association. The committee is recognized by the New York Public Service Commissions in the interpretations of the classification of accounts prescribed by the commissions.

Baltimore Electric Service Contract Controversy.

A large crowd of representative men met in the First Branch City Council Chamber, of Baltimore, Md., last Friday afternoon, to voice their objections to the "electric clause" of the natural gas ordinance, which is now the question of the day in that city. The hearing took place before a committee representing both branches of the Council, and many of the men who addressed the meeting claimed that they echoed the sentiments of the various improvement associations throughout the city. The portion of the clause which is arousing the most contention is as follows: "That during the period aforesaid (20 years) the Consolidated Gas, Electric Light & Power Company, of Baltimore, shall have the right to sell electricity at the rates established by it as shown in the schedule published by it under date of March 1, 1909, as filed with the superintendent of city lamps and lighting of the city of Baltimore and with the chief engineer of the City Electrical Commission and such amendments thereto as may have been made; provided, that if at any time during said period any of the rates for electricity as established and filed by the company as aforesaid or as the same may be adjusted under the terms hereof, for any of its various classes and conditions of service, shall be found to be higher than the average of the scheduled rates in force Jan. 1 of the current year, for the same class and conditions of service in the 10 cities of largest population of the United States, exclusive of Baltimore, adjusted to similar manufacturing conditions, then and in that event, the said company shall adjust its said rate or rates the average as aforesaid, but shall have the right to adjust its rates for its various other conditions and classes of service, so as to make all of such rates for electricity not higher than the average of the scheduled rates in force Jan. 1 of the current year, for the like classes and conditions of service in the said 10 cities, adjusted to similar manufacturing conditions. Nothing in this section shall prevent the company from at any time re-

vising its various rates for electricity, fixed as aforesaid, so that said rates shall be as high as the average of the scheduled rates for the same classes and conditions of service, in the 10 cities of largest population in the United States, exclusive of Baltimore, adjusted to similar manufacturing conditions. All adjustments made under this section shall be effective on and after the date when filed as aforesaid."

The Consolidated Gas, Electric Light & Power Company has spared no effort in convincing the public of the advantages that would attend the introduction of natural gas; and just as the ordinance is gaining in public favor, strong opposition has developed in connection with the clause quoted above. It will be noticed that this clause stipulated that the company shall have a 20-year contract from the city to furnish energy at the same rate which it is now charging; but should the average rate in 10 of our largest cities be at any time less than that which is being paid in Baltimore, then the company agrees to reduce its charges to meet those of the other cities. Again, if the company can bring the rate down to a still lower figure owing to lower manufacturing conditions, or by reason of new inventions or any other cause, then it is compelled to do so. Thus, the city would not be tied up for a period of 20 years to a definite rate, but the prices would adjust themselves in the satisfactory manner just noted.

The phrase in the electric clause concerning which there is greatest discussion is "like manufacturing conditions," and the meaning of these three words has been the bone of contention ever since the ordinance was first introduced. The controversy has caused the creation of a public utility commission to be brought forward, and the authorization of such a body may be made the subject of continued agitation.

In reply to those who hold that the provisions of the ordinance are complicated, it is pointed out that these provisions are all subject to the interpretation of a board of three engineers, only one of whom represents the company; on the particular clause here considered, and over which there has been so much discussion, this board will alone act, and as the company is only represented thereon by one member, it is pointed out that no possible unfair advantage of the clause can be taken.

Control of Worcester (Mass.) Electric Light Company Sought.

It is reported that an active campaign is under way in Massachusetts to secure the control of the Worcester Electric Light Company, which serves the second largest city in the State, and which has long had a high reputation as a prosperous central-station organization. Stone & Webster, of Boston, have sent out a message to all the stockholders of the company through Kinsley & Adams, brokers, of Worcester, offering $300 per share. The company is capitalized for $800,000, and the stock is quoted at $250 per share, very little of it being on sale in the open market. The company belongs in the 8 per cent to 10 per cent dividend class. In opposition to the offer of the Stone & Webster interests several of the largest stockholders of the company have sent out circulars announcing the formation of a holding company to keep the control in the city of Worcester. The holding company is to be named the Worcester Electric Securities Company, and the trustees of it offer $100 a share cash and two shares of the stock of the holding company, par value $100, for each share of the present electric light stock, the new stock to pay 5 per cent dividend. The capital of the holding company is set at $2,000,000. The interests that propose to keep the control of the company in Worcester claim to have in hand stock to the amount of $350,000, and are represented by Lincoln N. Kinnicutt, William E. Rice, Homer Gage, Charles M. Thayer, Frank A. Drury, T. Hovey Gage, Alexander H. Bullock and C. Henry Hutchins, of Worcester, and J. G. White, of New York. They announce that their intention is to give cheaper rates and to change entirely the policy of the company from the commercial standpoint.

On Sept. 27 President A. B. R. Sprague sent a letter to each stockholder urging that the holding company plan be rejected as untrustworthy. He pointed out the strong financial position of the company as evidenced by its record and the high prices offered for the stock, and stated that the company has always been well managed and now has large plans for expansion, its rates for both lighting and power comparing favorably with those of any other similarly situated central station. He stated that the disposition of the company's future rests with the stockholders, but that if any one of the offers is accepted that of Stone & Webster is the most desirable. The latest news indicates that the stockholders are in no haste to dispose of their much-desired securities.

Edison Cement Plant Visited by Baltimoreans.

A large party of Baltimoreans, including several city officials, journeyed to Trenton, N. J., last week and inspected the big plant of the Edison Portland Cement Company at Phillipsburg, which is operated entirely by electricity. The trip was arranged by the company for the purpose of showing the operation of its plant to city officials and those in the building and construction business in Baltimore, Washington and Philadelphia. In all there were about 325 in the party, which traveled in a special train from Philadelphia to Trenton and return, the train being run directly into the plant. Luncheon was served on the train and at the mill, where the party had the pleasure of meeting Mr. Thomas A. Edison, who made a witty speech of welcome, and wrote his autograph for each of his guests. The great use of electric power in the plant was particularly interesting to Baltimoreans in view of the present discussion there of the electric ordinance now before the City Council. The party saw great boulders of rock taken from the quarry, passed into the mill at one end and come out as cement at the other end. Each man was given a linen duster and cap as he entered the mill, and the costuming proved to be a source of endless merriment to the visitors. The city officials in the party were City Comptroller Harry F. Hooper, Mr. George M. Munson, president of Second Branch City Council; and all of the commissioners for opening of streets. The Builders' Exchange, of Baltimore, was also well represented in the party.

Illinois Central Electrification Progress.

For a long time the engineering department of the Illinois Central Railway has been engaged in studying the problem of the electrification of this company's tracks within the city of Chicago and the nearby suburban district. As the result of this study Mr. L. C. Fritch, consulting engineer of the Illinois Central Railroad, has just issued a preliminary report to the special commission appointed by the city to look after the suppression of the smoke nuisance. No definite announcements regarding electrification have, however, been made by the Illinois Central Railroad to the city commission, and it should be understood that the plans submitted so far are only tentative, because decisions on the method of generation and distribution of power and on the choice of motive-power equipment have not been made.

The present track facilities of the Illinois Central Railroad within the city and suburban district include eight tracks from Randolph Street to Sixty-seventh Street, 8.5 route-miles; six tracks from Sixty-seventh Street to Kensington, 6.5 route-miles; four tracks from Kensington to Riverdale, 2 route-miles, and two tracks from Riverdale to Flossmoor, 8 miles. The foregoing trackage comprises the main trunk line of the Illinois Central Railroad from its northern terminus in Chicago to the southern end of the suburban district. In addition to this trackage there are three branch lines also to be considered for electrification—the single-track line from Kensington to Blue Island, four miles; the double-track line from Sixty-seventh Street to South Chicago, five miles, and the double-track Omaha division from the Park Row station to Hawthorne, eight miles. The completion of the electrification project would include the re-

arrangement of the track system and the redistribution of local and express suburban trains and through freight and passenger trains. This work would require the reconstruction of the switching yards at the downtown terminal and south of Sixty-seventh Street. Suggested plans for carrying on the work of electrification progressively are as follows:

First, electrifying the local suburban district from Randolph Street to Sixty-third Street without rearranging the tracks, and, second, the following plans, which would require the rearrangement of tracks:

1. Local suburban service from Randolph Street to Sixty-third Street. 2. Local and express suburban service to Sixty-seventh Street and on the South Chicago branch. 3. Local and express suburban service to Kensington, South Chicago and Blue Island. 4. Local and express suburban service to Flossmoor, South Chicago and Blue Island, and through passenger service to Burnside. 5. Extension of electric service to freight trains to Burnside and all service to Hawthorne and in the Chicago switch yards. 6. Complete electrification for all service to Riverdale, South Chicago, Blue Island and Hawthorne; electrification for passenger service to Flossmoor.

At the present time the Illinois Central Railroad operates about 250 scheduled trains in and out of Chicago daily. With the electrification project completed it is tentatively estimated that the number of trains operated daily would be approximately as follows:

Suburban trains (proposed schedule)	396
Through passenger	82
Freight trains	190
Switching movements (estimated)	400
Total train movements daily	1,068

According to present estimates the daily ton-mileage of these trains will be as follows:

Suburban trains (proposed schedule)	895,440
Through passenger trains	431,610
Freight trains	1,789,776
Switching service	1,915,800
Total ton-mileage daily	5,032,626

The city commission was furnished with estimates for the maximum hourly demand on the power station which would be required for the six successive stages in the electrification work. The train service for the electrified local suburban tracks between Randolph and Sixty-third Streets is estimated to have a maximum hourly demand on the power station of 3500 kw and the complete electrified terminal to have a maximum hourly demand on the power station of 20,000 kw.

Details are not available regarding the motive-power equipment proposed and the method of power distribution. A map of the territory under consideration submitted to the city commission shows a tentative plan for the use of direct current delivered to the cars over a third rail. This power distribution arrangement includes six substations fed with high-tension current carried for the greater part of the way in conduit laid between the tracks and partly on a steel-pole aerial line. Supplementary feeders are carried similarly. The South Chicago and Blue Island branches are shown on the map to be operated with bracket-supported trolley lines.

New Interurban Railway Near Chicago.

The Chicago, Wheaton & Western Railway Company has just opened to traffic a portion of its line, four miles in length, extending from Pleasant Hill to West Chicago, in Du Page County, Illinois. The road is being extended to Geneva, Ill., on the Fox River, and the whole line will be 10 miles long. At Pleasant Hill it forms a connection with the Elgin branch of the Aurora, Elgin & Chicago Railway, and at Geneva it will connect with the Fox River division of the same electric railway system. It is expected that the complete line will be in operation by Nov. 1. The Aurora, Elgin & Chicago Railroad Company is operating the new road, and on its completion to Geneva through cars will be run from that city direct to the center of Chicago, passing through West Chicago, Pleasant Hill, Wheaton, Lombard and Elmhurst. The new road is operated by means of a third-rail, and is substantial and well built. Over the Fox River, at Geneva, there will be a seven-span reinforced-concrete bridge 50 ft. wide and 500 ft. long. At West Chicago, over the Elgin, Joliet & Eastern and Chicago & Northwestern steam railroads there is a steel through-truss bridge with two spans, each 126 ft. long. There are three cars, uniform with those used on the Aurora, Elgin & Chicago, now in operation on the completed portion of the new road, and they meet all trains at the Pleasant Hill junction with the older interurban system. The officers of the Chicago, Wheaton & Western Railway Company are: President, Mr. H. C. Wood; secretary, Mr. J. Sidney Condit; treasurer, Mr. W. F. McSwiney; chief engineer, Mr. I. W. Troxel. The office of the company is at 711 Rookery, Chicago.

Boston Edison Company's Annual Report.

Brief reference was made in the issue of Sept. 16, 1909, page 652, to the return of the Edison Electric Illuminating Company, of Boston, as filed with the Massachusetts Gas and Electric Light Commission for the year ending June 30, 1909. The following additional facts are of interest in connection with the operations of this company, which is much the largest central-station organization in New England.

The total capitalization of the company was 136,034 shares outstanding June 30, 1909, amounting to $13,603,400 at a par value of $100. The latest issue of stock was 9598 shares, offered to stockholders Dec. 18, 1908, at a price of $215 per share as approved by the Board of Gas and Electric Light Commissioners in 1907. There are 3295 stockholders.

In the year covered by the return the company supplied electricity to 23,588 customers in the districts of Boston, Milton, Dedham, Natick, Framingham, Somerville, Woburn and Medfield. In Boston proper there were 16,849 customers. The total cost of entire plant to June 30 was $22,158,254.22, there being additions of $1,536,432.44 to the property during the year. The principal items of addition were steam plant, approximately $423,000; electric plant, about $364,000; underground lines, approximately $240,000; lines, about $229,000, and buildings, about $125,000. The company's investment in plant June 30, 1909, was made up as shown in Table I, the largest item being underground lines, with buildings, electric plant and steam plant each about the same for second place in the investment.

TABLE I.—COST OF PLANT, JUNE 30, 1909.

Land	$1,372,821.97
Buildings	3,796,391.08
Steam plant	3,582,900.06
Electric plant	3,650,787.90
Lines	2,552,884.17
Underground lines	5,838,206.63
Transformers	292,556.50
Meters	748,903.03
Arc lamps	322,802.88
Total	$22,158,254.22

The cost of the plant was over $6,000,000 more than its total capital and loans. An interesting point in the itemized list of plant cost is a reduction of about $1,700 in the arc-lamp investment during the year.

The total energy manufactured during the year was 90,877,123 kw-hours, compared with 88,535,490 kw-hours in the preceding year. The cost of production is shown in Table II, exclusive of fixed charges.

TABLE II.—COST OF MANUFACTURE, YEAR ENDING JUNE 30, 1909.

Fuel	$346,660.06
Rentals of real estate	22,049.55
Oil and waste	5,257.78
Water	19,544.19
Wages at stations	170,686.10
Station repairs	10,137.26
Steam plant repairs	58,466.16
Electric plant repairs	48,120.47
Total	$680,921.57

The net cost of manufacture per kw-hour was 0.75 cent, compared with 0.822 cent in 1908. Continued improvement in the handling of the system is evident in the saving of nearly $50,000 in manufacturing expense with an increase of over 2.3 million kw-hours generated.

The total output sold is given in Table III:

TABLE III.—SUBDIVISION OF ENERGY SALES.

	Kw-hours.
Street lighting sales, estimated	8,052,307
Light and power by meter	35,464,748
Power only, by meter	12,129,804
Railways, by meter	907,370
Other companies, by meter	5,623,089
Total	62,177,318

Compared with the preceding year, the total sales increased by about 1,400,000 kw-hours, the principal gain being about 1,000,000 kw-hours in power sales.

The company's cost of distribution for the year was $432,048.09, or 0.695 cent per kw-hour sold. The details are shown in Table IV:

TABLE IV.—COST OF DISTRIBUTION.

Wages for linemen, care of lights, clerical labor in this department, salary or commission of collectors	$10,388.93
Repairs and renewals of lines	187,739.38
Repairs and renewals of meters, lamps and motors	41,497.55
Carbons	40,117.31
Incandescent lamps	152,304.92
Total	$432,048.09

The distribution cost per kw-hour sold was substantially the same as in 1908, and the ratio of kw-hours sold to manufacturers was practically the same, 68.5 per cent.

During the year the company burned 95,350 tons of bituminous coal costing $3.63 per ton. There was a saving of about $60,000 in coal cost during the year as compared with 1908. The maximum load was 36,324 kw, occurring on Dec. 22, 1908. The average number of men employed was 895, against 887 in 1908. The subdivision of employees was as follows: Generating steam division, 120; electric generating division, 104; distribution department, 292; offices and supply department, 287; construction department, 34; transportation department, 28; laboratory, 21; steam-heating service, 9. During the year there was a reduction in the steam-generating force of 16 men, due probably to the increasing use of very large turbo-alternators at the L Street station.

The company's income for the year is shown in Table V.

TABLE V.—INCOME.

Lighting	$2,753,854.87
Public street arc lights	402,889.96
Public street incandescents	100,971.03
Electric power for railways	57,008.43
Electric power for other uses	636,508.39
Energy sold other companies	160,110.02
Total	$4,111,342.70

On account of a 20 per cent rate reduction the income for 1909 fell below that for 1909 by about $118,000. The expenditures for the year 1909 were as shown in Table VI.

TABLE VI.—EXPENSES.

Manufacture	$680,921.57
Purchased electricity	498.27
Distribution	432,048.09
Office expenses and management	433,105.35
Miscellaneous, taxes, insurance, legal, etc	1,219,456.01
Total	$2,766,029.29

The company declared dividends of $1,424,389 during the year.

The equipment on June 30 had a total steam-generating capacity of 89,500 engine and turbine horse-power, the largest unit being a 16,000-hp Curtis turbine, located at the L Street station. Five turbines and 24 engines are listed, and there were installed 73 boilers having an aggregate rating of 33,889 hp. Practically all the apparatus in service is of the direct-connected type.

The total incandescent lamps (16-cp equivalents) installed on the company's circuits were 1,040,713 on June 30. There were 10 storage batteries, having a total rating of 50,740 amp on the one-hour discharge rate, all but one of these batteries having from 140 to 150 cells, the exception being an exciter battery of 82 cells and 1000-amp capacity on the one-hour rate located at the L Street station. There were 1626 direct-current arc lamps operated on overhead lines, 1075 arc lamps on alternating-current lines, 4300 arc lamps on Edison underground-tube lines and 1964 arc lamps on other underground lines. On June 30 there were 27,466 meters in use.

The total amount of wire on the system was 18,133,570 ft., the principal sizes used being Nos. 4, 6 and 0 B. & S. There were 2114 transformers on the system on June 30, the 20-light size being the most commonly used. The company had 26,641 poles set in streets or public ways and 2593 poles set elsewhere. The total length in streets or public ways occupied by overhead lines was 3,175,495 ft. There were 517,898 ft. of conduits installed on June 30, including 5,981,083 ft. of cable.

Change in Boston Elevated Power System.

The Boston Elevated Railway Company has begun to build a substation in the Forest Hills district of the city of Boston, for use in connection with the opening of the new elevated line from Dudley Street. It will be supplied with current from a turbo-alternator at the company's Dorchester power station and will contain the usual complement of step-down transformers and rotaries. This equipment will be the first alternating-current apparatus ever supplied from a power plant of the Boston Elevated system, the service having been exclusively direct current from scattered stations of high economy in the past, with the exception of a small amount of energy which has been purchased from central stations in times of emergency and extra heavy load. It is probable that as the Boston system expands, the use of alternating-current transmission will become more necessary, and the initial installation will be watched with interest. The turbo set will be rebuilt for alternating service at Dorchester, several years of experiment with a 2000-kw, direct-current turbine having indicated little success with the latter apparatus in railway work.

Completion of Chicago Quarry Street Station.

There is no end to the extensions of the generating equipment of the Commonwealth Edison Company, Chicago. Hardly has the first half of the new Quarry Street station, across the South Branch of the Chicago River from the Fisk Street station, been completed before work is under way to build the remaining half of the plant as originally planned. Plans described in the illustrated article describing this station, published in these columns in the issue of Jan. 2, 1909, will be followed out in the completion of the station. The finished building will be 463 ft. long and 208 ft. wide. The portion now in service is something over half of this and the new portion will be about 200 ft. x 208 ft. In the finished structure there will be six 14,000-kw turbo-alternators, and three of these are now in use. Figures are now being taken from contractors for the erection of the extension, and it is expected that the first of the three additional units will be placed in service early next summer.

In the Fisk Street station there are now 10 turbo-alternators in service with an aggregate maximum rating of 120,000 kw. The present rating of the adjacent Quarry Street station is 42,000 kw, making a total of 162,000 kw for the two plants at the present time. When the Quarry Street station is extended to its ultimate capacity, as designed, it will have a rating of 84,000 kw, which will bring the aggregate of the two stations, probably before the close of next year, to 204,000 kw. It is likely that the next step in the extension will be the completion of the Fisk Street station to its maximum capacity of 14 units, which will bring the rating of that station up to 168,000 kw, and when that is done, the two stations will have a combined rating of 252,000 kw.

Edison Power Improving Trolley Service Near Boston.

The recent purchase of power from the Edison Electric Illuminating Company of Boston by various trolley lines in the western suburban district has resulted in a decided improvement in the service. The Boston Suburban Electric Companies organization operates electric railway lines extending from the Newton-Waltham district westward to South Framingham and vicinity, and until recently the power supply has been derived

from a number of separate stations located at convenient points in the territory. Among these stations were the Homer Street plant at Newtonville, the plant of the Waltham Gas Light Company at Waltham, a station at Lexington, and another at South Framingham. The South Framingham and Homer Street plants were of antiquated design, but were necessarily operated on account of the layout of the system and the difficulty of furnishing power over long distances from the other and more modern stations. A few weeks ago it was decided to purchase energy from the Boston Edison Company, an equipment of rotary converters being installed in the Natick substation of the latter organization. The old plant at South Framingham was then shut down, being practically worn out as it stood, and immediately the improvements in the current supply were evident. There were a number of motors burned out before the motormen became used to the steady power on grades. In the Natick district the maintenance of normal line voltage under load has resulted in a much better movement of the cars, and it is proposed to discontinue the Homer Street station before it wears out on account of the high quality and efficiency of the Edison service. This station feeds one of the most important lines of the railway system, running from the Chestnut Hill terminus of the Boston Elevated Railway Company through the Commonwealth Avenue Boulevard to Norumbega Park and Riverside. It is probable that the Edison service will be still further extended on the Boston Suburban Electric lines within the near future. A substation will soon be built in Hopkinton for applying Edison service to the local trolley lines. By the terms of a recent consolidation, the Waltham station is now Edison property, and it is probable that it will be utilized in part for railway supply on the northern lines of the Suburban system. The bulk of the energy, however, is drawn from the main L Street generating plant of the Edison Company.

Development of a Suburban Electric-Service System.

Mr. George H. Lukes, general superintendent of the North Shore Electric Company, was the speaker at the regular weekly luncheon of the Electric Club, of Chicago, on Sept. 22. His subject was: "The Development of a Suburban Electric Light and Power System." He remarked on the number of families moving from the city to the suburbs in the vicinity of Chicago, and said that as these people were accustomed to city conveniences, it followed that there was a demand for electricity for lighting and other purposes in the suburban towns. The North Shore Electric Company was organized seven years ago by Mr. Samuel Insull and his associates. Mr. Insull had been impressed with the advantages of consolidating the electrical utilities over a considerable area, as demonstrated in England and elsewhere. He thought that the suburban territory around Chicago offered an opportunity for such a district electrical system, and the event has proved that he was right.

About 12 small central-station properties belonging to existing companies were purchased by the North Shore Company. These companies had been established and were owned by local people, as a rule, who were not familiar with the characteristics of central-station electrical supply, thinking that the business was subject to the same laws as an ordinary mercantile establishment, which is not the case, as experienced plant managers are well aware. The men in charge discovered that it was difficult to secure money to make necessary improvements, and as a result the properties depreciated and needed extensions were not made. The 12 plants were of the most diverse types, and if a dynamo had been taken from each one of them and preserved the collection would make the nucleus for an interesting electrical museum.

In the rehabilitation process undertaken by the new owner uniformity was necessary, and the first two or three years were devoted to designing and installing a standard system of distribution. Old transformers by the carload were taken out and larger and more modern ones were substituted. Uniform equipment for distribution on modern lines was developed, and the 60-cycle, four-wire, three-phase system was adopted as standard. The territory covered by the company was divided into three divisions. The northern division extends north from Chicago to Waukegan and northwest to Park Ridge; the western division extends west from the city limits to Elmhurst and southwest to LaGrange; the southern division lies south of the city proper and extends to Chicago Heights and Harvey. Single-phase distribution is used for lighting and small motors.

A modern generating plant was built in each of the three divisions. The northern station is at Waukegan, the western plant at Maywood and the southern one at Blue Island. In addition, the existing plant in Evanston in the northern division was retained and improved, being operated in connection with a district heating system. The new generating plants are of the most modern description, with water-tube boilers, automatic stokers and steam turbines. They supply electricity to centers of distribution by means of transmission lines designed for operation at 20,000 volts to 25,000 volts, but temporarily in service at 11,000 volts. There are three substations in the northern division, one in the western division and two in the southern division. Each substation receives a supply of electricity from at least two possible sources, one of these ordinarily being a connection with the network of the Commonwealth Edison Company of Chicago. In LaGrange the substation supplies electric energy for operating the local water works, and here there is a steam reserve, but it is very seldom used. In the southern division, in addition to the Edison relay, there are two duplicate transmission lines from the generating station to the substations.

A more rapid growth has distinguished the electric service in the suburban area than in the city of Chicago proper. Six years ago, when the North Shore Electric Company entered upon its campaign, it had 4000 customers, and now it has 14,000. The present generating capacity is about 14,800 kw. There is a considerable railway load. The Chicago Southern Traction Company, operating the interurban line to Kankakee on the south, takes all its electrical energy from the North Shore Electric Company, and the Chicago & Milwaukee Electric Railroad Company, operating between Evanston and Milwaukee, on the north, takes 2000 kw. The combination of a railway load and a lighting and power load helps the load factor materially, and also assists in effecting economies due to the great increase of output. The load factor of the North Shore system varies, in various localities, from 25 to 50 per cent.

The territory covered by the North Shore Electric Company surrounds Chicago on all sides. Its extreme length from north to south is 65 miles, and its extreme width 22 miles. The area served is about 600 square miles, although, of course, there are considerable portions of this district which are not as yet reached by the company's lines. The estimated population of the area is 150,000, and the number of inhabitants is increasing very rapidly—more rapidly, in fact, than in the city of Chicago itself. Mr. Lukes recalled a statement made by Mr. D. W. Roper, of the Commonwealth Edison Company, in a recent address before the Electric Club, in which that gentleman said that in a distance of half a mile on State Street the maximum consumption of electricity was 5000 kw. Contrasted with this, Mr. Lukes pointed out that the maximum load of the entire North Shore system was only about 5500 kw, so that nearly as much electricity is used in a distance of four or five blocks on State Street as in the entire territory of the suburban company. This fact, the speaker said, showed that it was manifestly impossible to sell electricity in suburban towns as cheaply as on State Street in Chicago. Nevertheless, the North Shore Company has about 1 customer in 10 out of the population in its area, while the Edison Company has only 1 in 20 in the city. The area of Chicago is about 190 square miles, and the density of the electric-service business is about 20 times as great in the city as in the suburban area. This condition is also an argument against the possibility of making rates as low in the suburbs as in the city proper.

Around Chicago the suburban population is clustered mainly along the lines of railroad which pay particular attention to suburban business. There are not many of these railroads—perhaps four—and, therefore, the suburban population radiates in streaks with wide territories between that are comparatively thinly settled. In these areas there is a great deal of property, much of it having good natural advantages that are comparatively undeveloped owing to the lack of good transportation facilities. Within a distance of from 8 to 12 miles from the city hall there are excellent suburban residence sites awaiting development. The speaker is of the opinion that something will have to be done to open these areas to suburbanites if the development around the city is to be symmetrical and well balanced.

There was little discussion following Mr. Lukes' address. The principal speaker was Mr. Dana Pierce, electrical engineer of the Underwriters' Laboratories of Chicago, who confined his remarks, however, principally to a cordial invitation to the members of the club to visit the laboratories and examine the work being done there in the way of testing electrical devices and materials.

Proposed Massachusetts Electric Railway Consolidations.

The Massachusetts Railroad Commission and the Boston Transit Commission sitting jointly gave a public hearing at the State House, Boston, on Sept. 27, in regard to the question of permitting the Boston Elevated Railway Company to acquire the securities of other street railways, as ordered by a resolve of the Legislature of 1909. The joint board is to report the results of its findings to the next General Court. Frederic E. Snow, counsel for the Boston Elevated Railway Company, urged the joint board to recommend legislation authorizing the company to acquire a controlling interest in other street railways, notably the connecting systems of the Boston & Northern, the Boston & Worcester, the Old Colony, the Blue Hill, the Lexington & Boston, and the Middlesex & Boston. If these systems could be thus controlled the operation would be centralized and a single physical transportation organization of about 1500 miles of track could be operated much more efficiently than the separate lines now composing the scattered roads. Mr. Snow said that the Boston Elevated charter forbids charging over a 5-cent fare, and for this reason actual consolidation would be out of the question, but the assumption of control by the legally authorized purchase of securities would enable the system to give first-class service and save money through operating economies. The gross assets of these companies are about $100,000,000. The hearing was continued to Sept. 28, when representatives of the Public Franchise League, of Boston, were to be heard in opposition.

On Oct. 5 the joint board will consider the need of new rapid transit lines in Boston and the proposition of the Boston & Eastern Electric Railroad Company to build a tunnel under Boston Harbor to Post Office Square, in connection with a proposed high-speed electric interurban line between Beverly, Salem, Lynn and Boston.

Hearings have been continued during the past week by the Railroad Commission on the Boston, Lowell & Lawrence Interurban Railroad project, the testimony being mainly that of citizens favoring the road.

Truckee River Water-Power Controversy.

Mention was made in these columns recently of the contract signed between the United States Reclamation Service and the Truckee River General Electric Company, covering certain rights and privileges on Lake Tahoe and its outlet, the Truckee River, in California. The contract was brought prominently before the general public by reason of a protest lodged with President Taft by William Kent, the well-known naturalist. After making a close study of conditions at Lake Tahoe, Mr. Kent has made the following statement: "After reading the proposed Truckee General Electric contract and after having studied its pedigree, I am led to believe that it was drawn by the company for the company and that Secretary Ballinger, acting for the Reclamation Service, signed it. To make it valid it remains that it should be given the endorsement of Mr. Ballinger, as Secretary of the Interior, or the endorsement of the President of the United States. It is now held up. In my detailed criticism of this document, sent to the President, which criticism was compiled only after careful consultation with a lawyer of high standing and an expert in hydroelectric power, I made the following charges against it:

"First, that, ostensibly intending to promote the cause of irrigation in the Truckee-Carson project, it resulted in an actual curtailment of prospective development of water for irrigation purposes; second, that the clause permitting control of the Truckee dam by the Government specifically stated that for any breach of the contract the United States could be ousted from such control; third, that the point of second diversion might be the ruin of much valuable property on the shores of Lake Tahoe, in which event the Government would incur the liability for damages and the company would reap the benefit; fourth, that the guarantee of an amount of water at all times rendered the Government further liable to the company for damages, should it be impossible to yield such flow; fifth, that to grant a roving commission to take anything the company might find of value, over a vast territory, was hostile to all ideas of reasonable concession; sixth, that the perpetual ownership of this power, without control in any way of the rates to be charged, or service to be yielded, was abhorrent to any just conception of public rights in the public domain; seventh, that the Government, by granting such rights, puts itself in the position of making an immense present to the beneficiaries, the magnitude of which gift can be seen should the Government turn around and endeavor to obtain its property back by condemnation. I further believe, after consultation with men knowing the details of the former power rights existing on the Truckee River, that these rights were not of any great value, first, because their title is subject to doubt, and second, because the amount of power that could be developed from the Truckee River would not amount to much or be an expensive thing for the Government to take back without injustice to the present holders."

A dispatch from Reno, Nev., states that Mr. W. P. Hammon, who, with other capitalists, now owns the Truckee River General Electric Company, has been making, in company with Mr. F. G. Baum, his engineer, and others, an inspection of the company's plant and the dam now being built by the Hammon interests and the Government. "We cannot talk of the Tahoe deal with the Government," says Mr. Hammon. "I can say, however, that the farmers will be protected. We intend to build more plants and extend our lines as the State advances. Further than this I have nothing to say."

German-American Patent Treaty.

The American Association of Commerce and Trade in Berlin has issued an announcement on the effect of the new patent treaty between this country and Germany. This treaty, which went into effect on Aug. 1, places American citizens on a decidedly better footing in regard to the utilization of patent protection in Germany, as it frees them from the obligation to work their patented inventions in Germany within three years from the granting of the German patent. Heretofore any failure to comply with this working obligation would, in the case of an action for revocation of the patent being brought against the patentee, result in the loss to him of his German patent.

This is no longer to be the case with the German patents of United States citizens, as the new treaty provides that the working of a patent in the territory of one of the contracting parties shall be considered as equivalent to its working in the territory of the other party. Hence, an American citizen who works his United States patent in the United States will no longer be required to work his corresponding German patent

in Germany in order to avoid loss of the German patent in case of an action for revocation being brought against him.

The question as to whether the provisions of the treaty are to apply also to existing German patents in regard to which the three-year term allowed for working already expired before the date on which the treaty went into effect is not decided yet; but many persons are of the opinion that even such patents will now be entitled to the benefits of the treaty, provided that no action for revocation was actually entered prior to that date. At any rate, it may be assumed that, in addition to all German patents applied for after that date, such older patents in regard to which the three-year term extends beyond that date will enjoy the benefits of the treaty. The new treaty, abolishing, as it does, a condition of affairs that has been felt as a hardship by American inventors, will no doubt induce many American inventors to apply for German patents where they would otherwise have abstained from so doing.

Patent Litigation Procedure.

In his opinion upholding the Selden gasoline automobile patent, Judge Hough took occasion to protest vigorously against the abuse in patent litigation arising from the methods of taking and printing testimony, exemplified in this case by a printed record of 36 huge volumes of record. A significant part of the protest is the intimation conveyed in favor of the submittal in patent cases of evidence orally before the trial justice. Following is the passage, which appears in the form of a footnote:

"It is a duty not to let pass this opportunity of protesting against the methods of taking and printing testimony in equity, current in this circuit (and probably others), excused if not justified by the rules of the Supreme Court, especially to be found in patent cases, and flagrantly exemplified in this litigation. As long as the bar prefers to adduce evidence by written deposition, rather than *viva voce* before an authoritative judicial officer, I fear antiquated rules will remain unchanged and expensive prolixity remain the best known characteristic of equity.

"But reforms sometimes begin with the contemplation of horrible examples, and it is, therefore, noted that the records in these cases, as printed, bound and submitted, comprise 36 large octavo volumes, of which more than one-half contain only repeated matter—i.e., identical depositions with changed captions and exhibits offered in more than one case. In reading the testimony of one side in one set of cases there were counted over 100 printed pages recording squabbles (not unaccompanied with apparent personal rancor) concerning adjournments—and after arriving at this number it seemed unnecessary to count further. In many parts of the record there are not five consecutive pages of testimony to be found without encountering objections stated at outrageous length, which may serve to annoy and disconcert the witness, but are not of enough vitality to merit discussion in 2000 pages of briefs. Naturally tempers give way under such ill-arranged procedure, and this record contains language, uncalled for and unjustifiable, from the retort discourteous to the lie direct. And all this lumbers up the court record room, while clients pay for it.

"Even when the evidence in equity was taken up by written answers to carefully drawn interrogatories, the practice was not marked by economy or celerity; but stenography and typewriting, the phonograph and linotype have become common since our rules were framed, have made compression and brevity old-fashioned, increased expense, and often swamped bench and bar alike by the quantity rather than the quality of material offered for consideration.

"Motions to expunge and limit cross-examination should have been made in these cases, though they are feeble remedies exposing counsel to personal reproach, and rendering judges afraid of keeping out of evidence what they cannot (on motion at all events) understand. But the radical difficulty of which this case is a striking (though not singular) example will remain as long as testimony is taken without any authoritative judicial officer present, and responsble for the maintenance of discipline, and the reception or exclusion of testimony."

Convention of the I. E. S.

Amid decorations that indicated the simultaneous existence of the Hudson-Fulton celebration, the Illuminating Engineering Society opened its third annual convention, on Monday, Sept. 27, in the Engineering Societies Building, New York, with an attendance that showed plainly the effect of the extra work in connection with the celebration upon the local members of the society, a large portion of the small assemblage being out-of-town members and guests. The registration at the close of the first session showed 100 members and 45 guests, but it is expected that more than 300 members will register before the closing session on Wednesday afternoon.

In presenting Mr. T. C. Martin, by whom the address of welcome was delivered, Mr. E. L. Elliott stated that not only was Mr. Martin a charter member of the society, but he was one of those to whom its formation was due, having been energetic in creating a sentiment in favor of its organization and in crystallizing this sentiment into action.

In his address of welcome Mr. Martin called attention to the prominent part taken by illumination in the present Hudson-Fulton celebration and also referred to the dependence of present-day civilization on artificial lighting. He stated that the celebration is one intended to recognize the victories of peace rather than war, and on behalf of the Hudson-Fulton Committee and as a member of the New York Section of the Society, he welcomed the members to the City of Illumination, as New York may rightly be called during the peace celebration.

The response to the words of welcome were made by Past-President Dr. Louis Bell, of Boston, who congratulated the New York members on the wide-awake appearance of their city, which from an illuminating engineering point of view is at present the most important place in America.

The presidential address of Mr. W. H. Gartley dealt with the physical and physiological aspects of visual perception, and outlined the elements which enter into the complicated process of seeing. The address was largely of a technical nature and was reserved for appearance in the *Transactions*, only a brief reference being made to it by Mr. Gartley. In discussing the work of the society, the president said that it receives hearty support from the two rival industries, electric and gas lighting, and has brought forth a higher standard of illumination since its formation. He expressed the opinion that courses in illuminating engineering will soon be commonly offered to students in technical colleges. It is significant that at the present convention two of the papers deal with photometric laboratories, one being for gas and the other electric lighting. Immense improvements have recently been made in lighting, especially by means of gas lamps. It is the object of the society to advance the science of illumination, and in this it is meeting with success.

The report of the Committee on Nomenclature and Standards, of which Dr. A. C. Humphreys was chairman, was submitted in the form of reports from two sub-committees. Dr. Louis Bell, as chairman of the sub-committee on the unit of light, mentioned the effective work of Dr. E. P. Hyde in having adopted by France, England and the United States an international candle. He called upon Dr. Hyde for a report of the work of the sub-committee. This report gave an outline of the history of the unit adopted and the steps leading to its adoption. The unit is the equivalent of the bougie decimale, is equal to the pentane candle and is equal to the present United States candle, which is now 1.6 per cent less than it was previously, the adoption of the international unit having taken place on April 1, 1909. The hefner is equal to nine-tenths international candle. Germany has recognized this ratio, but has not adopted the international candle, largely because the standard by which it is to be maintained or compared has not been thoroughly defined.

Dr. C. H. Sharp, as chairman of the sub-committee on photometric units, stated that the international candle, as specified

by Dr. Hyde, had been endorsed, as had also the lumen based on this candle.

In discussing the work of the former sub-committee President Gartley expressed his great satisfaction with the result. Dr. A. H. Elliott said that the method of employing incandescent electric lamps for candle-power comparison gives surprisingly good results, as shown by his personally submitting certain lamps to laboratories in Berlin, London, Washington and New York, the agreement in the various ratings being remarkably close. Dr. E. B. Rosa remarked that many of the countries that have as yet not adopted the above candle are merely postponing action until the meeting of the International Photometric Commission in Zurich next year. He suggested that the United States send a strong representation to that meeting so as to present properly the advantages of adopting this candle.

The discussion of the report of the sub-committee on photometric units was opened by Dr. A. E. Kennelly, who called attention to the increasing importance of the unit "lumen" in illuminating engineering, and entered a plea for the use of the e.g.s. system of units as a basis for the photometric units. Dr. Louis Bell claimed that by means of the slide-rule one can readily convert from the English to the metric system of units, and he indorsed the suggestion relating to the use of the latter. Dr. A. S. McAllister called attention to the fact that when the lumen is defined as the total flux produced by an international spherical candle divided by 4π the unit of length is not involved. Moreover, a flux density of 1 ft.-candle over 1 sq. ft. requires one lumen of flux, as does also a density of 1 m-candle over 1 sq. m. This same relation is true quite independent of the unit of length that may be chosen. Dr. C. H. Sharp argued that illumination should be expressed in neither foot-candles nor meter-candles, but should be stated as a certain number of lumens per unit area, according to unit of length selected. However, he doubted the advisability of an attempt to abolish the foot as the practical unit of length. Prof. E. B. Rosa thought that the metric system should be adopted in illumination calculations just as it has been introduced into magnetic calculations, while Mr. L. B. Marks said that much practical opposition is encountered when one attempts to use the metric system in engineering undertakings. Mr. C. O. Bond remarked that the mysteries of illuminating engineering as viewed by the layman will be increased neither by the substitution of the lumen per unit area for the foot-candle nor by the use of the meter for the foot as the unit of length.

"The Ethics of Illuminating Engineering" was the title of a paper by Mr. E. L. Elliott in which were outlined the relation of the engineer to his client and the relation of the engineer to his fellow engineer. The author stated that in military government there is one law which is made to cover all others, namely, "conduct becoming a gentleman and a soldier." If "engineer" be substituted for "soldier" there will be obtained combined ethics of illuminating engineering.

Mr. L. B. Marks expressed his admiration for the spirit which permeated the paper. Mr. Jno. Campbell directed attention to the relation of the engineer to his client, especially in the matter of the bearing of cost of installation upon the results obtained. He thought that the paper would form an excellent basis for a code of ethics for illuminating engineers. In commenting upon the fact that no reference was made in the paper to the illuminating engineers employed by manufacturing companies, Mr. H. T. Owens said that such engineers are of much assistance in educating the public regarding the proper installation and operation of lighting equipments. Mr. Norman Macbeth regretted the prevalence of the numerous salesmen who, claiming to be illuminating engineers, give advice on subjects concerning which their information is very limited. Such men cause the title "illuminating engineer" to be discredited in many quarters. In closing the discussion Mr. Elliott remarked that since the consulting engineer should be free from even the suspicion of biased opinion, an engineer employed by a manufacturing company is competent to do consulting work only when the problems involved relate to the particular types of devices marketed by this company.

In a paper entitled "The Work of Dr. Carl Auer von Welsbach in the Field of Artificial Illuminants," Mr. Geo. S. Barrows outlined the discovery of the remarkable properties of rare earths, the development of the methods for obtaining the desired elements in large quantities, the invention of the incandescent gas mantle, the invention of the osmium incandescent electric lamp and the production of pyrophoric substances suitable for the ignition of gas. The author said that Dr. Welsbach was the pioneer in the field of metallic-filament lamps, his work with the osmium lamp having led to the development of the other metallic-filament lamps.

In discussing Mr. Barrows' paper Dr. Angelo Simonini said that Dr. Welsbach should be ranked among the greatest of chemists for his work with the rare earths, which he has been able to produce by the tons, while formerly only minute quantities could be obtained. Dr. A. H. Elliott called attention to the great commercial importance of the pyrophoric substance, which will mean much to the gas industry. The stone-like substance when scratched with a sharp piece of iron will give off sparks capable of igniting gas jets, thus doing away with the pilot flame.

Dr. Geo. P. Scholl stated that patents obtained by Dr. Welsbach on tungsten lamp filaments are now held by the Westinghouse Lamp Company, which is developing his processes of manufacture. Dr. C. H. Sharp remarked that just as the electric lighting industry ows its present standing to Mr. Edison, the gas-lighting industry is equally indebted to Dr. Welsbach. Dr. Louis Bell outlined the influence of Dr. Welsbach on modern science, and expressed the opinion that he has proved to be the best chemical investigator of the past 50 years. He has been of especial service for his painstaking, thorough work with the rare earths.

In a paper entitled "The Progress of Illuminating Engineering in Europe" Mr. H. Thurston Owens outlined the street-lighting systems which were employed in the principal European cities.

Dr. A. H. Elliott said that in comparison with Europe, America has a much poorer system of maintenance for its public lamps. He entered a plea for the use of side-brackets for suspending street lamps from the side of buildings in order to allow the posts to be removed from the streets. Mr. G. S. Barrows explained the large ratio of gas to electric lamps in European cities by referring to the fact that gas was used there before electricity was introduced, while in this country electricity was used before gas became common.

In a paper by Mr. Albert J. Marshall, entitled "Diffusing Mediums," the prevailing use of ground-glass balls for covering lamps was condemned. The author attributed the use of such balls to their cheapness and low light-absorbing quality. They fail to produce the results desired because, instead of having a ball of light, say, 6 in. in diameter, there appears to be merely a spot of light at the center of the ball. Where conditions will permit, one of the most generally effective results may be obtained by the use of white or straw-colored opal globes, the exteriors of which have been sand-blasted or otherwise depolished.

Mr. L. R. Hopton defended the use of spheres on lighting fixtures for locations where the proper proportions are obtained. The parts of the equipment should be considered as a whole and not separately. He urged the necessity of so designing the installation as to permit it to be cleaned readily. Mr. P. S. Millar stated that the importance of using definite specifications for glassware is meeting with increasing recognition. Mr. L. B. Marks said that frequently custom dictates the selection of ground-glass balls. When the intrinsic brilliancy is not too great it is proper to use ground glass when it is preferred by the person paying for the equipment.

Illuminating engineering from the educational standpoint was discussed in a paper by Mr. F. K. Richtmyer, in which was given a list of experiments in photometric measurements which will be performed as college work during the coming year. The experiments are intended to give a working knowledge of several standard photometers, the use of primary and sec-

ondary standards, the errors to be avoided, illumination measurements, etc.

In the absence of the author, this paper was read by Mr. E. L. Elliott, who called attention to the fact that courses in illuminating engineering are now offered at Cornell, Armour, Massachusetts Institute of Technology and Swarthmore. He thought the time ripe for the colleges to give instruction to its architectural students in the elements of illuminating engineering. Mr. C. O. Bond said that the Illuminating Engineering Society could do good work by suggesting proper subjects for investigation by colleges along the lines of illumination, etc., the colleges being willing to undertake almost any investigation suggested. Prof. S. W. Ashe expressed the opinion that the 30 three-hour periods which the author proposed to devote to experiments with photometers could more profitably be spent in investigating of physiological phenomena, etc. Lectures relating to illuminating engineering practice should be delivered by visiting specialists and not by the regularly employed professor at the college.

The photometrical laboratory of the United Gas Improvement Company at Philadelphia was described in a paper by Mr. C. O. Bond. Use is made of incandescent lamps for comparison standards in photometric tests.

Dr. Edw. P. Hyde, director of the National Electric Lamp Association, presented a paper outlining the organization of the work of the physical laboratory of the association. The problems to be investigated in the laboratory are those that have to do with the production of luminous energy, those that have to do with the utilization of luminous energy, and those that have to do with the effects of luminous and attendant radiation. Under the first class will come the investigation of the laws of radiation and of the radiating properties of matter; the problems in this class are purely physical. Under the third class will come the investigation of the effects of light and the attendant radiation on the eye, on the skin, and on microscopic organisms; the problems in this class are purely physiological. The problems in the second class touch, on one side, the physical production of light, and, on the other side, the physiological effects of light; this division of the work will cover investigations on the absorbing, reflecting and diffusing properties of matter, photometry, color sensation and other color phenomena.

The papers by Messrs. Bond and Hyde were presented consecutively and discussed together, the discussion being opened by Dr. C. H. Sharp, who noted the trend of development in the science and practice of illuminating engineering as evidenced by the building of these two laboratories by commercial gas and electric interests. It argues well for the future when such interests are willing to expend much money for investigations from which the returns are as indefinite as those from photometric laboratories. In the past the development of illuminating gas has been along chemical lines, but in the future much will be done to utilize the gas to produce better illuminating effects. The laboratory described by Mr. Bond is well equipped for the photometry not only of gas lamps, but electric lamps also. The existence of the laboratory outlined by Dr. Hyde shows the effect of the change in attitude of financiers toward purely theoretical investigations, no small part of which may be attributed to the work done by the Illuminating Engineering Society. Dr. Sharp remarked that there is more than enough work to keep all of the laboratories busy, and entered a plea for co-operation to the extent that no two laboratories will be duplicating each others investigations. Mr. P. S. Millar recalled that about five years ago there were described before the American Institute of Electrical Engineers two photometric laboratories devoted to the interests of electrical engineering relating to lamps, while the present papers describe two laboratories organized to further the interests of illumination, for which the Illuminating Engineering Society stands. This fact shows the rapid development of illuminating engineering in this country. Although intended for purely scientific investigations, both of the laboratories are supported by companies organized for commercial purposes. President Gartley expressed the opinion that the opening of the above-mentioned gas laboratory represents a new era in gas-lamp photometry, and will result in the construction of laboratories for a similar purpose by numerous other gas companies. Mr. T. J. Litle, Jr., said that the many recent developments in gas lighting, especially in Europe, show that the illuminating gas business is on the verge of a revolution representing immense progress.

A paper by Dr. Angelo Simonini reported some experiments on the luminescence of incandescent bodies as carried out about 15 years ago in the factory of Dr. Carl Auer von Welsbach near Vienna. The author expressed the opinion that the cause of the high incandescence of the gas mantle is the alternating oxidation and reduction, or the changes from a higher oxide to a lower one and back again.

In a paper entitled "The Light of the Fire-Fly" Drs. H. E. Ives and W. W. Coblentz reported the results of an investigation of the physical properties of the light of the fire-fly. The spectrum of the light was photographed on plates sensitive to the whole visible spectrum. The spectrophotometric curve of the fire-fly, as compared with a carbon glow lamp, was obtained by comparison of the photographic densities of the negatives of the fire-fly and of the glow lamp. The distribution of radiant energy in the carbon glow lamp was determined, and by means of the spectrophotometric relationship the distribution of radiant energy of the fire-fly was derived. The light is found to consist of an unsymmetrical structureless band in the yellow-green of the spectrum, with a maximum at 0.57μ, and extending to 0.5μ and 0.67μ. The luminous efficiency of the fire-fly is calculated as 96.5 per cent as compared with 0.4 per cent for the carbon glow lamp, and about 4 per cent for the most efficient artificial illuminant. This value is obtained on the assumption that there is no infra-red radiation other than "animal heat." The authors' assumptions as to efficiency are equivalent to assigning to a 100 per cent efficiency electric lamp a specific output of 48 candles per watt. Such a lamp would give a single spectral line in the green. A lamp giving white light—and no other radiations—would have a specific output of 22 candles per volt.

The discussion on the paper on chemical luminescence and that on the light of the fire-fly was opened by Dr. C. H. Sharp, who mentioned the fact that the guess made many years ago by Dr. E. L. Nichols that the light from the Welsbach mantle is attributable not alone to the temperature of the flame, but also and more largely to the phenomenon of luminescence seems to be supported by the results recorded by Dr. Simonini, assuming that the alternating chemical changes furnish evidence of luminescence. The photographic method of investigating the spectra of light from weak sources as used by Drs. Ives and Coblentz is of great importance in spectro-photometry, while the results of the investigation of the light from the fire-fly shows the possibilities of immense improvements over present methods of producing light artificially. Dr. Louis Bell expressed his regret that the authors had not used a bolometer to ascertain what radiations, if any, are given off by the fire-fly beyond or within the spectrum recorded photographically. It is probable that numerous chemical reactions are accompanied by the production of radiations throughout limited ranges similar to that of the light from the fire-fly, and these should be investigated.

The session on Tuesday morning closed with the papers of Drs. Simonini, Ives and Coblentz still under discussion. It was arranged to continue the discussion on Wednesday morning.

The whole of the session on Tuesday evening was devoted to a lecture by Dr. C. P. Steinmetz on "The Physiological Effects of Radiation."

"The Allowable Amplitudes and Frequencies of Voltage Fluctuations in Incandescent Lamps" was the title of a paper by Dr. H. E. Ives, reporting the results of tests made upon carbon and tungsten incandescent lamps in which observations were made of the frequency at which flicker just disappeared. The flicker was produced by superposing an alternating e.m.f. upon a direct e.m.f. The results were recorded by means of

curves, which showed that there is a very large change in the permissible frequency with a slight change in the voltage.

Dr. Louis Bell presented a paper discussing some of the general principles upon which the use of shades and reflectors for artificial illuminants depends. The author stated that the actual loss of light flux in passing through diffusing balls may range from hardly more than 10 per cent where the surface roughening is very slight, up to 50 or 60 per cent in the case of very dense sand blasting or a globe of milky glass. With such globes the change in distribution is not material for practical purposes, but the sole function is to reduce the intrinsic brilliancy and thus increase the visual usefulness of the light as it is actually applied. The ordinary distributing reflector does not distribute to any considerable extent in the sense of changing the distribution, but merely somewhat increases the volume of light below the plane of the shade; obviously unless the lamp is provided with a ground-glass bulb, the glare is in no way reduced.

When wide distribution of light is desired it can best be obtained by a combination shade and reflector which will more effectively screen the lamp. As regards the coefficients of reflection of surfaces used for shades or reflectors, they are usually rather low, even a first-class mirror silvered on the back and kept clean seldom gives as high as 80 per cent, except under laboratory conditions. Metals, paints and enamels fall far below this, some of them down to 50 per cent or less. Diffusing coatings which tend to scatter the light over a wider surface than is given by the same shape of non-diffusing reflector, may have absolute coefficients of reflection quite as large as substances which reflect regularly. Prismatic glass acts, so far as it serves as a reflector, in virtue of total reflection in the prisms into which the glass surface is subdivided. The total effect of a plate of prismatic glass is to act as if it were slightly translucent, like a very thin silver film reflecting a large proportion of the light and letting some through. As a reflector its virtual coefficient is not widely different from that of other reflectors, but the absorption if the glass is clean is comparatively small, probably between 10 and 15 per cent only, so that the light which is not reflected gets through with this comparatively small loss. Etching decreases the direct element of illumination, so that pure diffusion is increased thereby relatively, so that excessive etching produces a result similar to that obtained when no prisms are used. Any diffusing surface given to a prismatic shade should be merely dense enough to avoid the brilliant streaks due to the proportion of rays that get through the shade without total reflection.

The problems encountered in heterchromatic photometry were outlined in a paper by Mr. P. S. Millar. In commercial practice serious discrepancies are encountered when the illuminants tested differ in color from available standards of luminous intensity. The author voiced the need for the consideration of standardization of methods in heterchromatic photometry.

Mr. Norman Macbeth presented a paper outlining some results obtained through illuminometery of lamps with various reflectors placed at different distances above the plane illuminated in a room having dark and light walls. Use was made of a four-lamp fixture placed within a room 12 ft. x 20 ft. Observations were made at heights of 4 ft., 6 ft. and 8 ft., the effective lumens being 1200.2, 1419.5 and 1464.2, respectively. The mean apparent candle-powers for the three heights were 382.4, 452.2 and 468.1, respectively. The variation in these values is attributable to the fact that the inverse-square relation is not accurately applicable to lamps with reflectors.

Much interesting specific information relating to factory lighting was given in a paper by Mr. L. B. Marks. Complete illumination data were given for five factories, four of which are devoted to the manufacture of typewriting machines and the fifth to the manufacture of ribbons, etc., for use in these machines. Measurements were made of the illumination at the machines and other working spaces under actual operating conditions in the daytime and at night, the measurements for artificial light having been made in exactly the same location at machine, bench, etc., as the respective measurements made under daylight conditions. Use is made throughout the factories of one 16-cp lamp at each machine and for each bench hand. The illumination produced by each lamp is confined to a very small zone, which is brilliantly illuminated, while contiguous parts of the working space are in comparative darkness. The author found that the intensity of artificial illumination is excessive, and in many cases greater—in some cases from 10 to 20 times—than the intensity of the natural illumination that is adequate for the same work. He suggested the introduction of suitable general illumination, proper location of the lamps, reduction of intrinsic brightness of the light sources, improved diffusion and direction of light and a moderate intensity of illumination.

The operating efficiencies of some commercial installations of lighting systems were treated in detail in a paper by Mr. A. L. Eustice. Reports were given on 66 tests made by the author. The results showed that the conditions under which lighting systems are installed—employing the same type of unit—are so varied that it is almost impossible to lay down or establish definite specific consumption factors to be used promiscuously, and particularly by the layman or one lacking a great amount of practical experience in the field. The author expressed the conviction that in all cases it is essential to provide additional wattage above the amount calculated in order to take care of depreciation, not only of the candle-power of the units employed, but also of the system between cleaning periods. The depreciations of various systems due to accumulations of dirt differ largely, since a unit which does not depend primarily upon reflecting glassware will naturally suffer least in application of the unit to commercial systems.

A paper by Dr. E. P. Hyde and Mr. J. E. Woodnell gave the results of tests upon vapor-tube lamps in the New York Post Office. The lamps operated at power factors of 63 and 69 per cent and consumed 2.42 watts per mean spherical candle.

The results of tests made upon a vapor-tube lamp 176 ft. in length and 1⅞ in. diameter installed in a room 65 ft. long, 29 ft. wide and 18 ft. high, were reported in a paper by Dr. C. H. Sharp and Mr. P. S. Millar. The tube used 21.5 amp at 220.3 volts, or 3451 volt-amp; the power factor was about 73 per cent, the real watts being 3451. The lamp was found to produce a total of 17,400 lumens, or 5.5 lumens per watt, which is equivalent to a specific consumption of 2.49 watts per mean spherical candle-power. Of the total lumens produced by the lamp, 41.2 per cent were effective on the illuminated plane.

Annual Meeting of the Rejuvenated Sons of Jove.

The seventh annual meeting of the Rejuvenated Sons of Jove will be held in Cleveland, Ohio, on Oct. 14 and 15, 1909, with headquarters at the Hollenden Hotel. According to the old Grecian mythology on which the ritual of the order is built up, the fifteenth day of October in each year was sacred to the ranking deity and was called Jupiter's Day. Mr. J. Robert Crouse, No. 260, of Cleveland, Ohio, is the reigning Jupiter of the Sons of Jove, and has decreed that the convention be concentrated so far as possible into the one day, Oct. 15. Meetings of the standing committees will be held on Oct. 14, and a reception to visiting Jovians will be given at the Hollenden Hotel on the evening of the 14th. On Jupiter's Day the business session will be held in the morning; in the afternoon a class of 100 or more initiates will be led from darkness into light. The Joviation in the evening will consist of a dinner and vaudeville entertainment in charge of Messrs. H. H. Cudmore and H. C. Rice, of Cleveland.

A quarter of a million clever envelope fliers advertising the order and its annual meeting are being distributed by over 300 electrical firms throughout the country. Over 500 new members have been added during the year, making a total membership of about 2500.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has denied the application of the bondholders' committee for approval of the proposed reorganization of the Third Avenue Railroad Company. The opinion as given is a lengthy one, and was written by Chairman Willcox and Commissioner Maltbie. Among the reasons given for refusing to sanction this reorganization plan are that the assets of the property are not of sufficient value to justify the proposed capitalization of $68,516,000; that the present company is overcapitalized, and the outstanding stock and bonds are not represented by actual property; that the net earnings will probably be less than the estimate given by the receiver; that there is no evidence that the company would earn a sufficient net income to pay the interest on the adjustment bonds, amounting to $32,000,000; that there is no likelihood that there would ever be any dividend earned on the $20,000,000 of proposed common stock; that it is unwise to issue securities on probable earnings; that such overcapitalization would lead to inferior service and unwarranted exactions; that the control of the corporation would pass from the stockholders to the bondholders, and that the reorganization plan involved the capitalization of taxes, unpaid interest, repairs, renewals and other improper capital charges. The announcement of this refusal had little effect upon the Third Avenue stock in Wall Street, as it was quite generally understood from the beginning that the commission would refuse the application.

In a letter addressed to the Public Service Commission of the First District of New York on Sept. 22, T. P. Shonts, president of the Interborough Rapid Transit Company, offers to build a four-track subway up Madison Avenue, to be connected with the four existing subway tracks on Park Avenue at about Thirty-eighth Street, and continuing the four tracks up Madison Avenue to 149th Street, connecting two tracks with the existing subway tracks and continuing the other two tracks northerly on Jerome Avenue to 194th Street; also to construct two tracks from the present West Farms division of the subway, commencing at about Simpson Street, running over Westchester Avenue to Pelham Bay Park. If the Pelham Bay Park route and Jerome Avenue route are built they will be of elevated construction. This line, if constructed, will open up a new area along Jerome Avenue in the Bronx and a new area along Westchester Avenue to Pelham Bay Park in the Bronx.

A hearing has been ordered for Oct. 6 on the application of the Nassau Electric Railway Company for permission to issue $730,000 in bonds. The purpose of this issue is to retire an equal amount of the consolidated mortgage bonds of the Atlantic Avenue Railroad Company. These bonds fall due on Oct. 1, 1909.

The commission has held several hearings upon the application of the Bronx Gas & Electric Company for approval of a bond issue of $1,500,000. President Rosenquest, of the company, explained at a hearing that only $740,000 of this amount would be issued against a first mortgage on the company's property. He also stated that the $486,500 of capital stock of the company had been paying 5 per cent dividend during the years 1904 to 1908, inclusive.

The Public Service Commission, Second District, of New York, has announced, in an opinion by Commissioner Decker, its decision in the case of C. E. Wheaton against the Elmira, Corning & Waverly Railway Company. This company charges a 10-cent fare for about 3 1/7 miles between Holbert's crossing and Waverly, equal to 3 2/5 cents per mile. It charges the same fare between Waverly and all points west of Wilson's crossing, including Holbert's crossing. Between Wilson's crossing and Chemung village (west end) it charges a 5-cent fare for a distance of 2 4/5 miles and has fixed this fare limit to accommodate travel to and from Chemung. The same reasons that induced the company to put its Chemung 5-cent fare limit at Wilson's exist for placing its Waverly 5-cent fare limit at Holbert's. The opinion states that assuming the 10-cent fare between Waverly and Chemung (west end), 4 2/3 miles, is not unreasonable, it is apparent that a 10-cent fare to or from the town of Waverly becomes too high a short distance east of Chemung.

The commission does not disturb the 5-cent fare from Wilson's to Chemung or return, but it does hold that on passenger traffic between Holbert's and Waverly and between points east of Holbert's and Waverly, where a 10-cent fare is charged, the fare of 10 cents is unjust and unreasonable and must not, during a period of at least one year, exceed 5 cents per passenger. The order is limited to one year on account of the company's present poor financial condition, and it has leave to apply and show cause for modification or abrogation of the order at any time during that period. When the company's contemplated extension of service to the center of Waverly shall be effected the question whether the fare limit for Waverly traffic should be brought eastward a short distance may be raised. It appeared in this case that the complainant is trustee of a school district and that he applied originally to the company for a school commutation rate between Waverly and Holbert's crossing and intermediate points, but his application was refused, and he then brought complaint to this commission against the 10-cent fare applying on all passengers.

Massachusetts Commission News.

The Clinton Gas Light Company, operated by the Massachusetts Lighting Companies of Boston, has appealed to the Board of Gas and Electric Light Commissioners from the decision of the Selectmen, of Clinton, dated Aug. 31, 1909, upon the petition of the Connecticut River Transmission Company for the right to erect and maintain poles and wires in that municipality's territory.

The Clinton authorities granted the Transmission Company's petition for various locations specified in the order, requiring that the lines be protected by lead or other suitable covering between Nashua Street and the Lancaster Mills, and recommending that so far as practicable the Transmission Company and the Clinton Gas Light Company shall use the same poles; that the lines of the Transmission Company shall be located at least 20 ft. above the highway, and that the maximum potential shall not exceed 14,000 volts under normal working conditions. It was further ordered in the franchise that the Transmission Company shall not refuse to deliver electricity for power or manufacturing purposes to any applicant for the sole reason that the applicant is a small user of electricity; that it shall not furnish power for reselling at a rate higher than the Transmission Company could furnish energy directly to consumers; that the wires must be placed under ground at such time as the Clinton Gas Light Company puts its own lines below the surface; and that if the town establishes a municipal plant the Transmission Company must furnish on request of the Selectmen energy to a maximum of 800 hp at the company's Fitch Street substation. The life of the franchise is twenty-eight years.

The Clinton Gas Light Company submits that it is aggrieved by the action of the Selectmen, and the board will give a public hearing upon the matter on a date not yet assigned. The appeal resembles those of the Fitchburg Gas & Electric Light Company and the Worcester Electric Light Company, lately heard before the full board in public sessions, the respondent in all three cases being the Connecticut River Transmission Company. In the Fitchburg case the commission authorized the latter to sell power in blocks of 300 hp and over, restricting the sale to smaller users to the established central-station organization. Arrangements are now under way and an agreement is now before the commission for approval whereby the Transmission Company will sell energy to the local company. Power is now being supplied to the Park Hill Mills, of Fitchburg, by the Transmission Company under the terms of the order issued by the board in the Fitchburg appeal. The Worcester decision is now pending in the board.

Wisconsin Rate Commission.

An important decision has just been rendered by the Wisconsin Rate Commission which affects every public utility operating in the State. In the case of Oscar J. Berend vs. the Wisconsin Telephone Company, the right of any public utility to exact a penalty for the non-payment of bills within a certain specified time has been definitely settled pending only a possible adverse decision by the Supreme Court.

The Wisconsin Telephone Company's contract contains the following clause: "This company reserves the right to require the subscriber to keep on account with it a sum not exceeding $10 to guarantee payment of bills rendered on this contract." The plaintiff refused to satisfy the foregoing requirement and upon the telephone company's refusal to give service he petitioned the commission for an order.

In its decision the commission has recognized the reasonableness of the respondent company's rule providing for a cash deposit. For every public-service corporation is required by law to furnish adequate and efficient service to the public according to the development and state of the art at the time the service is performed and to exact therefor only reasonable compensation. It must keep its plant in proper state of repair and continue its service without cessation whether profitable or not. It is by statute subject to public supervision as to the extent and capacity of its service as well as the charges it may lawfully exact therefor, and it is imperative that just compensation be promptly returned to the company for all service rendered by it to the public.

Consequently, the commission has laid down the following rules for the protection of a public utility against loss of operating revenues because of uncollected accounts, and for securing the prompt receipt of all moneys due for service performed or product furnished, which rules may be lawfully prescribed and enforced by any public utility:

1. It may require of any patron the deposit of a reasonable sum as security for the prompt payment of bills when due.
2. It may require satisfactory security to be furnished in lieu of such deposit.
3. It may allow a discount upon bills paid on or before a stated day or exact a penalty for failure to make payment within a certain time.
4. For neglect or refusal on the part of any patron to comply with any of the legal rules and regulations established it may discontinue service to such patrons.

CURRENT NEWS AND NOTES.

AURORA AFFECTS TELEGRAPH SERVICE.—On Saturday of last week the telegraph throughout eastern United States, and in Europe throughout Germany and over a greater part of the Continent, was seriously disturbed by magnetic effects accompanying an aurora borealis.

ELECTRICAL ENGINEERING AT RUTGERS.—The department of electrical engineering of Rutgers College, New Brunswick, N. J., has moved from its former quarters to the new Engineering Building, which it occupies jointly with the departments of civil and mechanical engineering.

TWENTY-ONE HUNDRED MILES BY WIRELESS.—According to a San Francisco telegram, wireless telegraph communication is being maintained between the wireless tower of the *Chronicle* and the Oceanic steamship *Alameda* at Honolulu, the distance separating the two stations being 2100 miles.

"TELERADIOPTICON."—A dispatch from the City of Mexico states that Alberto Sanchez, an electrical engineer, who is an inmate of Belem prison, declares that he has invented an apparatus whereby light waves as well as sound waves may be transmitted over a telephone wire. The prison officials vouch for the claims made by the inventor.

HIGH-SPEED WIRELESS.—According to the London *Times,* wireless messages were recently sent by the Poulsen system from Great Britain to Denmark at the rate of 200 words per minute, the distance being 600 miles, of which 200 miles are overland. According to the new Poulsen system the message is transmitted from a perforated tape, and received on photographically sensitized paper.

GERMAN AUTOMATIC TELEPHONE EXCHANGE.—The first automatic telephone exchange system in Germany has been installed at Hildeshein. The Siemens & Halske Company has taken up the American automatic telephone system for exploitation in Germany, as the result of a visit some months ago of a number of its engineers to this country to report upon the success of the system as installed here.

FRENCH TECHNICAL STUDENTS IN AMERICA.—M. Millerand, the French Minister of Public Works, is an advocate of a measure to send graduates of French technical schools to the United States for further study. He says he wishes to create in the United States for French engineers an institution analogous to the art school maintained at Rome for artists, the students to remain in the United States for 18 months or 2 years.

GOVERNMENT OWNERSHIP OF TELEGRAPHS.—The Congress of the Chamber of Commerce of the British Empire, now in session at Sydney, N. S. W., has given a strong endorsement to the proposal that the British Empire should own the telegraph services within its bounds, and passed a resolution requesting the various Governments to form a combined scheme for complete State ownership of electric communication between Great Britain, Canada, Australia and New Zealand.

BRITISH MARCONI AGREEMENT.—As noted in a previous issue, the British Government has purchased the seven land stations in the United Kingdom of the Marconi wireless system. The company will, however, retain the transatlantic stations at Poldhu and Chifden, and, of course, the installations worked by it on board steamers. The operators at present employed by the Marconi land stations will for a time remain in the service of the Post Office, and probably a number of them will be taken permanently into the Government service.

WARSHIP SPECTACULAR LIGHTING.—In an interview printed in the New York *American,* Mr. Thomas A. Edison, in reply to a question as to what feature of the electrical display on the Hudson on last Saturday evening struck him most favorably, said: "That by the British warships. It's a shame that our warships made so poor a showing in comparison to that of the British. I never saw a more brilliant display or more intelligent management of electric light than that by the British Saturday night. I felt ashamed of our failure. I thought we would lead the world's navies in that respect, as we lead the world in so many other things."

CHRISTIAN SCIENCE TREATMENT OVER THE TELEPHONE.—It is reported from Los Angeles, Cal., that Christian Science absent treatment over the telephone is assuming such large proportions in that place as to increase very materially the business of both of the telephone companies there, and sometimes to conflict seriously with traffic over long-distance lines. It is stated that healers in Los Angeles and Pasadena give treatment by wire to patients in Riverside, Santa Barbara, San Bernardino and all over southern California. At first operators were nonplused in cases where the patient called up a healer and held the connection in absolute silence while the long-distance treatment was proceeding over the wires; hearing no sound the operators would cut in, and getting no response they pulled the plugs, thus leading to complaint as to the service.

SALE OF BELL HOMESTEAD.—The city of Brantford, Canada, has purchased for park purposes the homestead where Alexander Graham Bell began work on the invention of his telephone.

AMERICAN ELECTROCHEMICAL SOCIETY.—The next meeting of the society will be held in New York on Oct. 28, 29 and 30. The headquarters will be at Hotel Chamberlain, while sessions for the reading and discussion of papers will be held at the Chemists' Club and at Columbia University.

ALTERNATING-CURRENT RECTIFIER.—Prof. John J. Montgomery, of Santa Clara College, has invented a type of alternating-current rectifier which, according to California newspapers, will revolutionize the use of electricity. No information in detail is given beyond the statement that a rectifier for charging an automobile battery is only 4 in. square in horizontal section and 8 in. high. An illustration in the newspaper accounts indicates that the apparatus is a revolving brush or commutator rectifier.

THE CHICAGO "UNION LOOP" MUST GO!—At a recent public dinner in Chicago, Mr. Edward J. Brundage, corporation counsel, spoke of the Union Loop in the central business district of Chicago, used by the elevated railways, as a makeshift which has contracted the heart of the town "so that it has been for many years too congested to pump the streams of prosperity through the arteries of the city." Mr. Brundage was emphatic in saying that the loop must go and that a system of subways must be built to take its place. He added that the citizens and city officials must get together and decide on the type of subway, its route and the manner of building and operating it.

CANADIAN ELECTRIC SMELTERS.—Dr. Eugene Haanel, director of mines for the Dominion Government, has announced that arrangements are being made for the establishing of the first electric smelter in Canada in connection with the iron and steel industries at Sault Ste. Marie, Ont. Arrangements are now being made for the construction of a number of furnaces similar to those in use in Sweden. A second electric smelting enterprise, involving the investment of about $7,000,000, is contemplated for treatment of iron ores on the Ottawa River at Chats Falls, Ont., where a great power site has been secured by a company headed by Mr. Louis Simpson, of Ottawa. Dr. Haanel is convinced that this is but the beginning of an electric smelting industry in Canada which will grow to immense proportions.

THE WINNIPEG ELECTRIC LIGHTING CONTROVERSY.—The fight between the city of Winnipeg and the Winnipeg Electric Company, details of which have previously been given, has been brought to a crisis by the city taking out an injunction to restrain the company from erecting any more poles without civic permits. In the injunction the city declares that the company owes $127,000 with interest on taxes on its power plant, and further declares that the company has no electric light plant in Winnipeg apart from poles and wires. The company has 16 days from Sept. 21 in which to answer the city's claim. The whole question will develop into an issue as to the legal status of the company within the city of Winnipeg. That it will be a long law suit there is no doubt, as both sides to the controversy are prepared to carry the question to the House of Lords, in England, the supreme court of judicature in the British Empire.

BUFFALO INDUSTRIAL SHOW.—The 1909 Buffalo Industrial Show will run from Oct. 6 to 16, and it is planned to have it eclipse all previous efforts. Street illumination will be the prominent feature. At Lafayette Square a large arch is being erected which will be illuminated and decorated with thousands of electric lamps, the arch to form a gateway leading to Broadway, on which street the old Sixty-fifth Arsenal is located, in which the show will be held. Large columns bearing clusters of lights will lead to another illuminated gateway at the entrance. Room for a band will be provided over each gateway. Main Street will be illuminated as well, the total number of lamps to be used outside being about 10,000. The interior will also be beautifully illuminated with large electroliers. The Buffalo General Electric will have a large exhibit showing tungstens, cooking devices, flatirons, etc. The Cataract Power & Conduit Company will show something interesting in the power line.

ACCIDENT TO COLORADO HYDROELECTRIC PLANT.—The United Hydraulic Company's plant at Georgetown, Col., which furnishes power throughout Clear Creek and Gilpin Counties, was disabled Sept. 20 by the breaking of a flange on one of the waterwheels. This puts a number of large mining companies of the two counties out of commission, which will suffer heavily, as their pumps cannot be operated. Upon the breaking of the flange the station was flooded to a depth of 6 in. over the floors, which in places were lifted several inches by the pressure. The water did no great damage in Georgetown, but the storage reservoir was practically drained before water could be shut off, and it will be several days before full supply will be available. No mine working, so far as known, has been flooded by the escaping water. A delay of about two days in operation will be caused. The Georgetown plant has capacity of about 4000 hp and has been supplying electric power for Clear Creek and Gilpin Counties for years.

AUTOMATIC SWITCH FOR SINGLE-PHASE MOTOR.—A patent issued on Sept. 21 to Mr. Harold B. Scheibe covers a switch arrangement for automatically opening the auxiliary starting circuit of a single-phase induction motor when the rotor has attained a predetermined speed. Centrifugal force is not utilized, the device being actuated by the cross magnetizing flux produced in the primary core by secondary magnetomotive force when the rotor has reached the proper speed. Use is made of a plunger electromagnet for operating the switch for disconnecting the auxiliary starting circuit. This magnet is located within the primary field core with its plunger ends at points of equimagnetic potential so far as concerns the magnetomotive forces of the main and auxiliary starting circuits. However, as the rotor accelerates from rest there is produced, in space-quadrature with the main field flux, a flux which exerts a pull on the plunger of the electromagnet. This pull is sufficient to open a switch in the auxiliary starting circuit when the rotor speed has reached the desired value.

TELEPHONE SUBSCRIBER SUES FOR 20 CENTS.—Mr. H. L. Strom, a lawyer, has brought suit against the Chicago Telephone Company to recover 20 cents which he asserts was collected by the telephone company from him in excess of the rate provided by the ordinance. The telephone company has many thousands of residence customers who have nickel-in-the-slot instruments with a minimum guarantee of $1.50 a month. The arrangement is that where the actual number of calls during a month does not equal 30 and the customer has to make up the deficiency, this amount may be applied on any excess charge over the $1.50 in succeeding months within a three-month limit. The telephone company's arrangement for making collections under this provision is somewhat complicated, unless carefully explained, and many disputes have arisen under this clause of the ordinance. Mr. Strom's suit seems to have grown out of this difficulty, and a number of his fellow subscribers have expressed their admiration for his resolution in suing the company, and have extended offers of financial assistance. Mr. B. E. Sunny, president of the telephone company, has promised to investigate the claim made by Mr. Strom, and declares that the company has no intention of violating any provision of the ordinance.

Wireless Telegraphy in the U. S. Navy.

UPON the first introduction of wireless telegraphy the U. S. Navy grasped its possibilities and was among the foremost to utilize it aboard ship. From the crude sets of the first days the navy has kept abreast of the times and now possesses installations on most of its ships that are second to none as regards efficiency, reliability and work accomplished. The navy has no standard set as yet, and among the ships may be found nearly all the prominent makes except that of Marconi. The only Government vessel at the present time having the latter installation is the revenue cutter *Seneca*.

Up until the latter part of the year 1904 the German Slaby-Arco outfit was the only set used to any extent. It was of the coherer and Morse writer type and gave fair service, although being, of course, far inferior to the present-day sets. The Slaby-Arco transmitter, however, survived and is to be found to-day on a great many of the smaller ships. Its compactness—the spark-gap, condenser jars, sending inductance and ventilating motor being all contained in one—makes it very desirable for small cruisers and gunboats. But the receiver, with its coherer so unreliable and unworkable when there was atmospheric disturbances, soon gave place to the electrolytic detector. On many of the ships the operators made detectors of their own by using a small incandescent lamp bulb, knocking off the tip and after breaking off the filament filling it half full of a 20 per cent solution of sulphuric or nitric acid, one of the platinum leading-in wires being broken off flush and the other one bent over toward the broken off one. This detector, with a potentiometer, a couple of dry cells and telephones in multiple around it, was good for reliable work from 75 to 125 miles. The DeForest electrolytic soon replaced this form of detector and was much more sensitive; up until the spring of 1908 it was as sensitive and as reliable a detector as was in use. On shore stations a bare wire was used, but on board ships the wire had to be encased in glass on account of vibration and rolling of the ship, the wire and glass being ground off flush so that the depth of immersion in the electrolyte made no difference in its sensitiveness. The bad feature about it was, however, that unless the operator was extremely careful a strong spark close by would burn the point off and it then had to be taken out and the point and glass again ground flush by rubbing on a whetstone. The carborundum and perikon detectors are now used

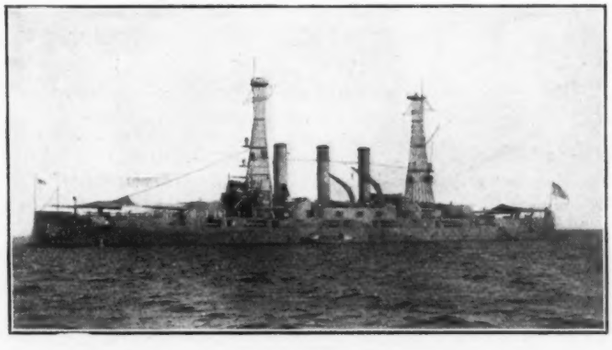


FIG. 1.—BATTLESHIP WITH TWO CAGE MASTS.

almost exclusively in the navy on the large ships, and at a great many of the naval shore stations.

In the present-day installations there are six principal makes of wireless sets represented on board naval vessels, namely, the Shoemaker, DeForest, Fessenden, Stone, Telefunken and Pierce; with the exception of the Telefunken all are of American make. The Pierce is used on the three scout cruisers, *Salem, Birmingham* and *Chester;* the firm making this set has since gone out of business.

The "capacity" of these different makes ranges from 2 kw to 5 kw and most of them are capable of standing a 50 per cent overload. The *Connecticut* at the present moment is having installed a 25-kw Fessenden outfit in connection with the high-powered stations the Fessenden Company is erecting for the navy on shore. This set has yet to be given a thorough trial, but the present indications are that the power is too great to be successfully handled on shipboard unless some radical changes are made to allow more clearance from the transmitter to the antenna. Thus far the 3-kw sets have been doing the most satisfactory work and reaching the longest distance, nearly all of them having a higher power factor than the 5-kw sets. Most of the small cruisers and gunboats use the old Slaby-Arco transmitter with its rotary turbine interrupter (a very efficient piece

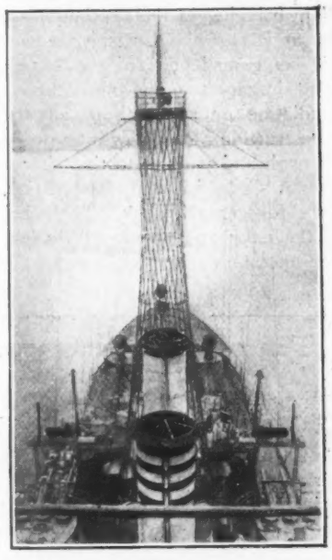


FIG. 2.—VIEW OF ONE CAGE MAST AS SEEN FROM THE OTHER.

of apparatus, by the way) and a 25,000-volt induction coil. In most cases use is made of a Shoemaker or DeForest receiver.

In the North Atlantic battleship fleet are also quite a number of composite sets, but instead of the Slaby-Arco the transmitter is a Shoemaker or DeForest with a 3-kw or 3.5-kw Cutler-Hammer or Holtzer-Cabot 60-cycle, 110-volt motor-generator and 20,000-volt step-up transformer; this set is as near a standard as any in use. The new copper-coated Shoemaker jars give splendid service, and no more trouble is encountered from blistering. The spark-gap in most cases is a modified one made at the navy yards. It consists of a ¼-hp blower with rubber hose attached to the lower spark-gap, which is a piece of brass pipe about ¾ in. in diameter, the other spark point being a blank piece of zinc of the same diameter and about ⅝ in. in thickness. The blast of air across the spark-gap increases the radiation to a considerable extent, and by keeping the sparking points cool prevents fluctuations in the spark and gives it a higher pitch and clearer sound. By making the leads from the alternator to the primary of the transformer as short and straight as possible and by increasing or decreasing the power by field regulation rather than by the use of impedance or resistance a very high power factor is obtained. The aerial is directly connected to the transmitting inductance and with a loading coil in the antenna and a coupling around 15 per cent seems to give better results and radiation than the inductive connection.

The motor-generator is brought up to speed by simply closing a switch which operates an automatic starter, the operator taking about five seconds. The transmitting key is usually a standard telegraph key, but its function is only to close the circuit through an electromagnet which operates the main key, which is in series in the primary circuit of the transformer. Protective devices, made of condensers or of high-resistance carbons, protects the motor-generator set as well as the ship's lamp and motor circuits from kick-backs.

The detector used almost universally now on the battle ships is the carborundum or perikon, or both. The electrolytic type of detector, while being very sensitive, is not adapted for fleet work. The carborundum gives splendid results when properly

handled, it being impossible to destroy its sensitiveness by strong sparks or static electricity; on the contrary, it seems to improve; however, for long-distance work it cannot come up to the perikon. The perikon and a very fine wire electrolytic detector are of about the same sensitiveness. The perikon soon becomes dead, however, from strong sparks or static electricity, although recovering by being given a short rest. The best combination seems to be the carborundum for short distance and the perikon for long distance. The telescopic transformer type of tuner, with variable condenser, gives splendid results as to selectivity and in bringing in the maximum strength of signal.

Flat-top loop aerials of the L-shape are used almost exclusively, the grid being made up from 4 to 10 phosphor-bronze wires strung 18 in. apart. The new cage masts have not affected the radiation or receiving to any noticeable extent, although the construction of the new masts necessitates running the antenna through and parallel to the after-mast mainly.

The Continental Code is used for official work and the American Morse for general work. There being considerable work between the navy and commercial ships and shore stations, the navy operators must be skilled in the use of both codes.

Test of Electromagnets.

By C. P. Nachod.

The tests below, which may be of interest to magnet designers, were made to determine the most suitable form of magnet of given external dimensions, and, although not rigorously exact, they still indicate the quantitative variations among several possible forms. Figs. 1 to 6, inclusive, show the magnet

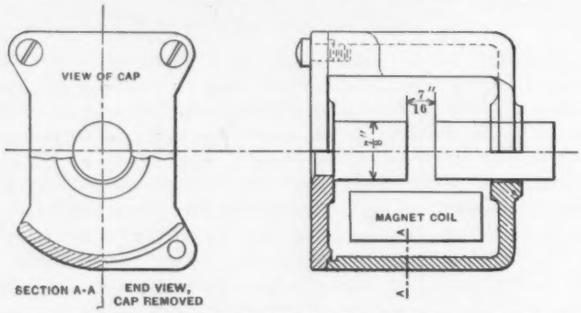


FIG. 1.—ELECTROMAGNET PARTIALLY ENCLOSED IN IRON FRAME.

and the changes wrought upon it; and being reproduced to the same scale, may readily be compared. The tests were made to show the effect of locating the air-gap in different parts of the same magnetic circuit, the variation in exciting power for the same initial pull and length of gap being measured; to show the effect of changing the position of the magnetizing coil with respect to the air-gap; and to show the effect of variation of the diameter of the magnet core.[1]

The magnet, shown in Fig. 1 partly in section, consists of a partially enclosing cast-iron frame to which is secured a cast-iron cap by four screws. A Norway-iron core is riveted to the cap, and a cylindrical plunger or armature of the same material slides in the frame, actual contact therewith being prevented by a brass tube having a 1/32-in. wall. The same frame and cap were used in all the tests. The area of the poles in this case is 0.6 sq. in. To lift the given weight, 3.4 lb., with the given air-gap, 7/16 in., 2400 amp-turns are required in the magnetizing coil.

In Fig. 2 the frame was cut through approximately mid-way, and a single long core riveted to the cap. This has the effect of substituting for the single air-gap inside the coil two air-gaps in parallel outside it and through the frame, the polar area now being increased to 1.09 sq. in. It was found to require 3610 amp-turns, an increase of 50 per cent to give the same pull with the same gap.

[1] See Design of Plunger Magnets, *Elec. World*, Sept. 21, 1907, p. 563.

In Fig. 4 the cap screws were removed and the air-gap placed between the cap and the frame, the coil remaining *in situ* with the frame, the area at the end of the frame being 2.16 sq. in.; 3720 amp-turns were found necessary, which is slightly greater than in the preceding example.

In Fig. 3 the coil was kept against the cap; and the effect of placing the coil nearer the air-gap evidently greatly reduced

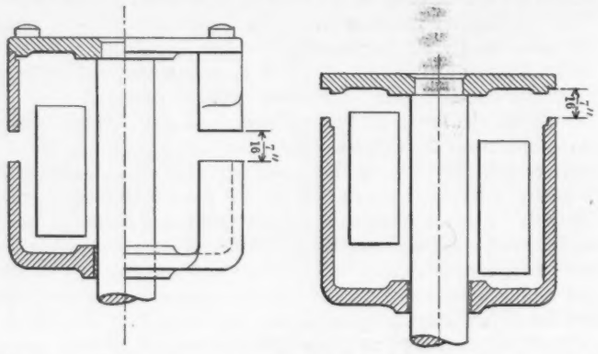


FIG. 2.—AIR-GAP MIDWAY IN FRAME. FIGS. 3 AND 4.—AIR-GAP BETWEEN CAP AND FRAME.

the leakage flux; for only 2890 amp-turns, instead of 3720, were required.

In Fig. 5 the diameter of the core was increased to 1 15/32 in., the plunger remaining 7/8 in., the air-gap being internal to the core as in Fig. 1. This requires only 2150 amp-turns, as against 2400 in Fig. 1. The mean polar area is 1.08 sq. in., and is regarded as a mid-way section of the frustum of the cone determined by the pole faces.

Finally, in Fig. 6 the only change over the preceding case is

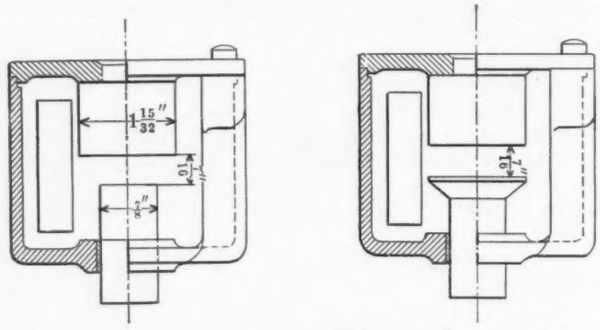


FIG. 5.—INCREASED DIAMETER OF CONE. FIG. 6.—MUSHROOM-SHAPED ARMATURE.

the substitution of a mushroom-shaped armature having the same polar area as the core, 1.69 sq. in. This form required a minimum excitation of only 1790 amp-turns, and is best adapted to the purpose; while Fig. 4, with 3720 amp-turns, is the poorest of the various forms tried.

Electrical Coal-Cutting in Great Britain.

According to our London contemporary, *Electrical Times*, despite the prejudice that exists, even in official quarters, against electric power in mines, the electric coal-cutting machine is making steady headway in Great Britain. Its great mechanical rival is the cutter worked by compressed air; but, although compressed air had a big start, electricity is gradually creeping up and bids fair in a few years to take the lead. Last year, according to Government statistics, the electric coal cutters in use increased from 643 to 737, while the compressed-air machines moved from 850 to 922. The electric coal cutter has made the greatest strides in Scotland; *per contra*, it is hardly known in South Wales, where hand work is almost exclusively used. As only 5 per cent of the coal output is machine-cut, the vastness of the field open to electricity may be realized.

Niagara Energy in Buffalo.

THE energy transmitted from Niagara Falls to Buffalo is distributed in the city over the lines of two companies, namely, the Cataract Power & Conduit Company and the Buffalo General Electric Company. With the exception of a small amount of energy used for lighting in an outlying district, which is purchased from the Niagara, Lockport & Ontario Power Company, all of the energy utilized by the Buffalo General Electric Company is obtained from the Cataract Power & Conduit Company and reaches the city by way of transmission lines from the two stations of the Niagara Falls Power Company on the New York side and the station of the Canadian Niagara Power Company on the Ontario side of the Niagara River. The former two stations are practically two parts of one station, being separated by only the width of a canal, while the last-named station is joined electrically to the other two by 10 three-phase underground cable tie lines. Thus the three stations operate as a unit to assist one another electrically, but they are physically separated so that the possibility of all being out of service simultaneously may be said to be infinitesimal.

The energy obtained by Buffalo from the three stations just named is transmitted at 22,000 volts over four separate pole lines, two on either side of the Niagara River. There are two terminal houses in Buffalo, one supplied by three separate three-phase circuits on the American side of the river, the other supplied by three similar circuits on the Canadian side of the river, the two terminal houses being interconnected by three-phase tie lines. From these two terminal houses the Cataract Power & Conduit Company distributes energy to its Buffalo customers. The rate at which the energy is employed and the character of the service can be judged from the fact that the industrial load represents the demand of more than 160 customers, whose motors vary in rating from 75 hp to 1200 hp.

On account of the great daily and seasonal variations in the

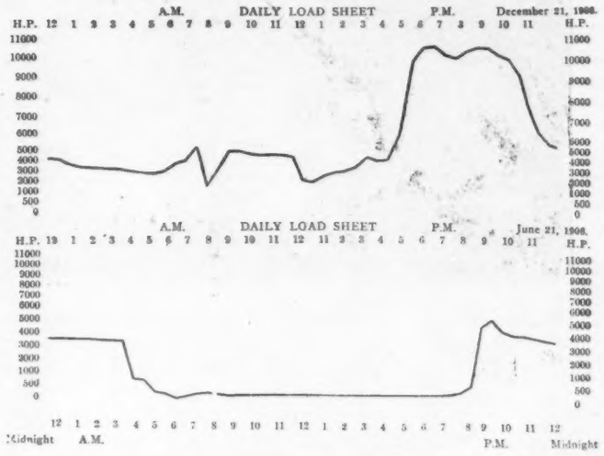


FIG. 2.—LOAD CURVES FOR DEC. 21 AND JUNE 21, 1908.

electric railway load reaches 15,000 hp; the city's motor-driven pumping load, 2400 hp; the industrial load, 16,800 hp, and 13,000 hp is often taken by the Buffalo General Electric Company. The load on a lighting system, it is impossible to assign definite values to the loads. However, the loads on the system of the company often reach the following values:

Three-wire, 220-110-volt direct-current load, 4000 hp; 60-cycle, single-phase load, 4000 hp; 25-cycle, polyphase motor and lamp load, 1300 hp; 500-volt, direct-current motor load, 1600 hp; Brush arc-lighting load, 2700 hp; mercury-rectifier arc-lighting load, 65 hp. These maxima do not occur simultaneously, so that the maximum load on the station cannot be found as the sum of these values. The character of load and its variation can be judged from the accompanying curves showing the load for the longest and shortest days of the year, respectively.

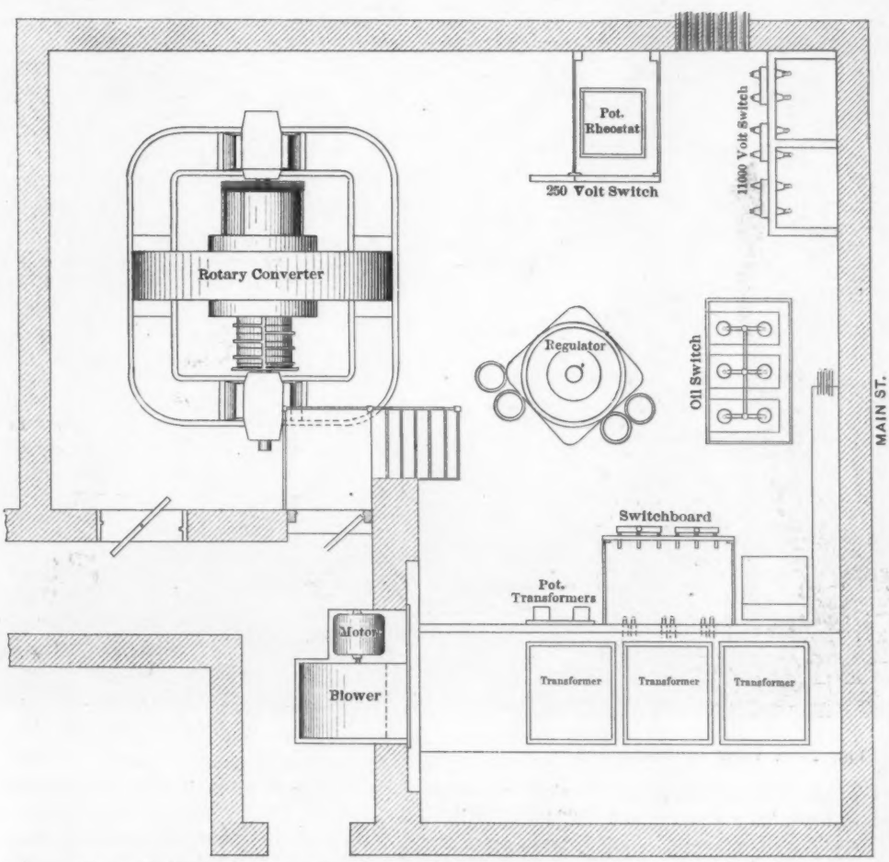


FIG. 1.—GROUND FLOOR PLAN OF SUBSTATION, COURT AND MAIN STREETS, BUFFALO.

In order to carry the above load the company has erected five substations in addition to its main station on Wilkeson Street, which in itself is a substation. In this station, which contains a 14,000-hp equipment in transformers, rotary converters, frequency changers and motor-generator sets, there is an emergency storage battery rated at 800 kw-hours. The Babcock Street substation contains 2700 hp, the Ferry Street 2000 hp, the Swan Street 1350 hp, the Court Street 670 hp, and the West Seneca substation 600 hp. Of these substations the one at the corner of Court and Main Streets is probably the most interesting. It contains a single six-phase rotary converter, with the necessary 11,000-volt switches, transformers, regulators and distributing switchboard, which occupy a flood area of less than 400 sq. ft. in a concrete-lined room dug beneath the sidewalk. This substation equipment, which is located in the heart of the business district, delivers energy to the network of distributing cables less than 10 ft. away. It is used only for peak loads, and is operated by one of the attendants regularly employed at the Wilkeson Street station.

FIG. 1.—ILLUMINATION OF GRANT'S TOMB, RIVERSIDE PARK, NEW YORK.

The Hudson-Fulton Celebration in New York City.

THE Hudson-Fulton celebration, commemorating the three hundredth anniversary of the discovery by Henry Hudson of the river that bears his name and the one hundredth anniversary of the beginning of steam navigation on the Hudson by Robert Fulton, began in New York City on Saturday, with the most notable and picturesque marine spectacle yet seen in this country. The celebration will cover a period of two weeks, eight days of which will be devoted to parades and ceremonies, dinners, receptions and various exercises in and about New York City; while the remaining days of the celebration will be taken up with pageants and exercises in the various cities along the Hudson.

For the naval pageant on Saturday, the greatest fleet of war vessels ever gathered in American waters was brought together in the Hudson, forming a line nine miles long. The American navy is represented by 52 war craft, of which 16 are battleships. Besides these there is a squadron of British vessels, and warships from Germany, France, Italy, Holland, Argentine, Mexico and Cuba. The parading fleet of vessels, 40 miles long and divided into 10 squadrons, escorted the facsimiles of the *Half Moon* and the *Clermont* from Staten Island up the Hudson to the water gate or landing at 110th Street, and then circled the battleships and cruisers of the international fleet at anchor off Riverside Drive.

Copyright, N. Y. Edison Co.

FIG. 2.—A VIEW OF FIREWORKS AND ILLUMINATIONS.

At night the entire city was transformed. The Hudson River, from the Statue of Liberty on Bedloe's Island to Spuyten Duyvil, was ablaze with light. The entire Jersey coast, from a point opposite the Battery to where the last of the line of warships is stationed, was illuminated. Lamps had been strung along the hulls and rigging of the big liners at their docks and

the fronts of manufacturing concerns abutting the shore were a mass of incandescent lamps. As the light of day faded and the millions of incandescent lamps flashed into view, the outlines of towering skyscrapers and bridges were merged into the night and became magic structures painted into the sky by slender ribbons of fire.

It is impossible to describe the view on the Hudson at night. Promptly at 8 o'clock there gleamed against the dark Palisades the forms of all of the warships outlined in light. Skeleton warships they seemed as the night grew blacker, for nothing of them could be seen except the glowing outlines that were traced against the night. Photographs can give no idea of the splendor of the sight, for it is almost impossible to obtain night pictures of ships owing to the length of exposure necessary and

Copyright, N. Y. Edison Co.

FIG. 3.—ANOTHER VIEW OF FIREWORKS AND ILLUMINATION OF WARSHIPS ALONG HUDSON RIVER.

to the movement of the vessels with the waves and with the tide. Those shown herewith give but a faint impression of the actual scene. Besides the warships at anchor were yachts, tugs, steamships and pleasure craft gorgeous in incandescent lights; the *New Amsterdam*, Holland's great steamship, was one of the most exquisite sights in all the brilliant display. Coupled with the electric illumination on the river the fireworks display was beyond doubt the grandest ever given in New York. As far as the eye could see the vast expanse of water seemed to be glowing crimson and gold, a liquid mass of fire.

ILLUMINATION OF BRIDGES.

Although interest on the opening day was centered on the display in the Hudson River, the East River, which separates the Boroughs of Brooklyn and Queens from Manhattan, was not neglected. As is well known, this river is spanned by four of the largest suspension bridges in the world—the Brooklyn, Manhattan, Williamsburg and Queensboro—and each of these bridges will be lighted throughout the celebration. From anchorage to anchorage, following the catenary curve of the cables and also the lines of the towers, driveways and walks, ⅛-in. steel stranded messenger wires hold, by means of porcelain cleats spaced every 3 ft. or 4 ft., electric conductors of No. 10, No. 12 and No. 14 wire to which the lamp sockets are attached. The greater part of the circuits are of No. 10 wire and these are fed on the Brooklyn, Manhattan and Williamsburg bridges from direct-current, three-wire cables run from the Brooklyn and Manhattan shores, while the lamps on the Queensboro Bridge are fed from transformers spaced along the structure. The lamps used on the bridges are rated at 8 cp, spaced 2 ft. apart, and the Underwriters have given permission to connect from 60 to 100 lamps on a circuit, or as many lamps as the wires will carry current for. Although rubber-covered wire is employed, the current-carrying capacity of weatherproof wire is permitted. In this way it was possible to use made-up circuits in lengths of 1000 ft. and to insert cutouts after the installation was completed and at convenient points. Approximately 13,000 lamps are in circuit on the Brooklyn Bridge and slightly less on each of the other bridges. The electricity for lighting the bridges is furnished by the New York and the Brooklyn Edison companies.

ILLUMINATION OF PUBLIC STRUCTURES.

In addition to the lighting of the bridges across the East River, the committee having the illumination in charge has contracted with the various illuminating companies in the five boroughs to light various public buildings during the celebration. These include the City Hall, Washington Arch, the Viaduct Bridge on Riverside Drive, the Soldiers and Sailors' Monument and Grant's Tomb in Manhattan; the Borough Hall in Richmond; the Borough Hall, Flushing Town Hall and Jamaica Town Hall in the Borough of Queens; the Borough Hall, the Soldiers and Sailors' Monument, Water Tower, Institute of Arts and Sciences and the Martyrs' Monument in Brooklyn; the Borough Hall in The Bronx.

FIG. 4.—FULL SIZE "HALF MOON," JERSEY CITY.

With the exception of the tomb of General Grant in Riverside Park, all the buildings are outlined with 8-cp incandescent lamps. It was considered most appropriate to illuminate Grant's Tomb by means of searchlamps. The incandescent lamps are spaced 18 in. apart on the Viaduct and 1 ft. apart on the public buildings. The same general scheme is employed as on the bridges, the circuits and lamps being held by steel messenger wires.

The lighting in the boroughs of Queens, Richmond and The Bronx in connection with the celebration is naturally limited, inasmuch as the seat of the event is in the boroughs of Manhattan and Brooklyn, where the parades will occur. The Borough Hall in Long Island City is outlined and supplied with electricity in the ordinary way by setting a transformer upon a neighboring pole and running the necessary service wires to the lamps. The latter are switched into and out of circuit by means of an oil switch located on the pole at the transformer. At Flushing the old Flushing Town Hall is outlined with lamps and supplied in a manner similar to that in Long Island City, and the same is true of the Jamaica Town Hall. The number of lamps on the three structures in the order given is 650, 415 and 686, respectively.

The chief item of illumination on Staten Island, or the Borough of Richmond, and the most spectacular is a large electric sign with the word "Welcome." This sign is erected on what is known as Pavilion Hill, which commands a view of the entire harbor of New York from Manhattan to the Narrows. The letters are 20 ft. high and the sign contains approximately 1000 16-cp lamps. The sign will be lighted from the evening of the twenty-fifth to and including the second of October. Aside from this sign, the Borough Hall is outlined in a manner similar to that in the other boroughs, the Tucker Electrical Construction Company, of New York, the contractors for the commission, doing the work.

The public illumination in Brooklyn is quite striking. The Soldiers and Sailors' Monument, the Water Tower and the Institute of Arts and Sciences are all situated at the entrance to Prospect Park, one of the most beautiful spots in the country. The section is also the highest in the borough, so that the three monuments of art can be seen for some distance. The Martyrs' Monument is also located on the crest of a hill at Fort Greene Park. On the tripod at the top of the shaft is an enormous urn in which red fire is played. The shaft itself is lighted by means of arc lamps at its base. The Borough Hall basking in the reflected light from illuminated skyscrapers surrounding it is strikingly bedecked with varicolored flags and with incandescent lamps. There are about 3600 lamps used to bring out the classic lines of the structure.

Copyright, N. Y. Edison Co.

FIG. 5.—NEW YORK CITY HALL.

In Manhattan the City Hall has lines of electric lamps stretched across the front and sides of the building, up and down the pillars and encircling the dome. All its lines are brought out by the style of decoration employed and the effect is very pleasing. The Washington Arch shows up splendidly under the festoons of fire and every detail of the Sailors and Soldiers' Monument is likewise brought out by simple treatment with incandescent lamps. In addition to the public build-

ings, the line of parade in Manhattan is lighted from one end to the other by incandescent lamps fed from the multiple arc circuits and fastened to 25-ft. iron poles spaced three to the block on each side of the avenue. The line of parade extends from 110th Street and Eighth Avenue to Fifty-ninth Street, thence across to Fifth Avenue and south to Fourth Street. The lamps are spaced 2 ft. apart and approximately 30,000 lamps are distributed along the line. On Fifth Avenue between Fortieth and Forty-second Streets, facing the Public Library, is the Court of Honor. Here 36 pillars of white stucco work, surmounted with Corinthian caps and huge gilded balls, tower 55 ft. above the sidewalk. There are 18 columns on each side of the street and three rows of lamps joining in a circle at the center extend between columns, which are 32 ft. apart. A row of lamps is also placed around the gilded balls and at the two ends and corners the rows of incandescent lamps cross diagonally in addition, being joined in bisecting rings at the center. The lamps are spaced 6 in. apart and besides being looped from column to column parallel with the avenue are also looped across the roadway. The pillars rest on pedestals 7 ft. square at the base and the columns are cylindrical in shape and 5 ft. in diameter. The incandescent lamps are for the most part hidden by foliage. There are over 7000 lamps in the Court of Honor and these were placed in position by means of two 50-ft. movable scaffolds.

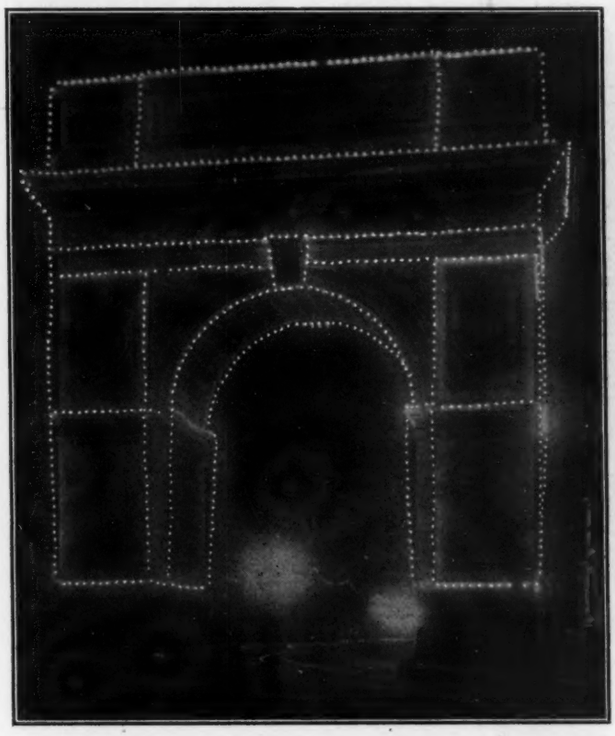


FIG. 6.—WASHINGTON ARCH, WASHINGTON SQUARE, NEW YORK.

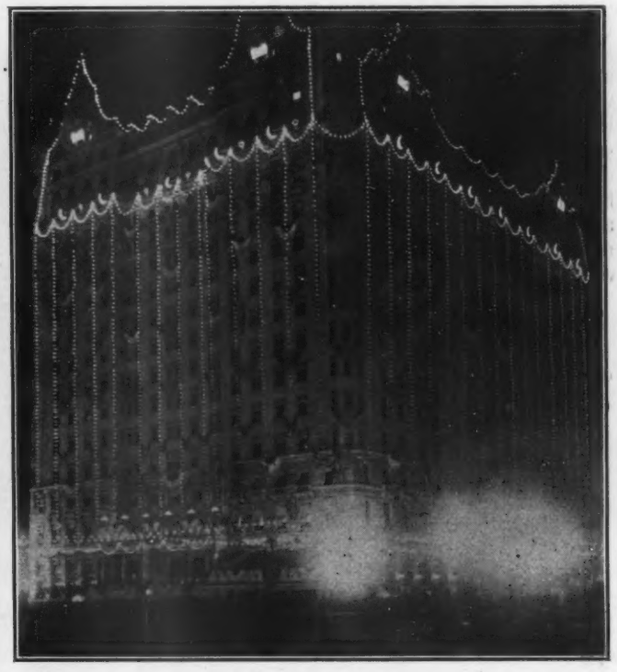


FIG. 8.—PLAZA HOTEL, NEW YORK.

The crowning feature of the public lighting is the battery of searchlamps on Riverside Drive and 155th Street overlooking the Hudson. This is the same battery of scintillators designed by Mr. W. D'A. Ryan, of the General Electric Company, for use at Niagara Falls, and the New York Edison Company had to install two 200-kw rotary converters near by to supply the direct current for the 40 lamps. The beauty of the scene, especially when the riot of color is mixed with rays of the powerful scintillator, actually beggars description; it must be seen. The battery of searchlamps is located on one of the

FIG. 7.—HOTEL ASTOR, NEW YORK.

FIG. 9.—VIADUCT, RIVERSIDE DRIVE, NEW YORK.

highest points along the river front, extending out over the railroad tracks 120 ft. below and commanding a view of the Hudson River from Staten Island to a point opposite Riverdale. The searchlamps are placed in a row north and south and occupy a space more than a block in length. Beside them are large circular disks subdivided into sections containing colored screens, by the use of which fantastic color effects are produced. One hundred feet in front of the searchlamps are steam pipes ranging in height from 25 ft. to 100 ft. The pipes are fed from a 200-hp boiler and the steam forms the curtain upon which the line of scintillators is thrown, as a picture is thrown upon a canvas screen. To give body to this curtain of steam, large quantities of black powder are burned and bombs exploded close to the steam outlets so that the smoke from both the powder and the bombs will mix with the steam. The aerial curtain made by the plumes of steam and smoke mounts nearly 100 ft. There is a great number of color combinations obtainable and various effects which are visible for miles.

LIGHTING ON THE WATER FRONT.

Along the river at the water gate at 110th Street, where the distinguished visitors and guests were gathered on Saturday,

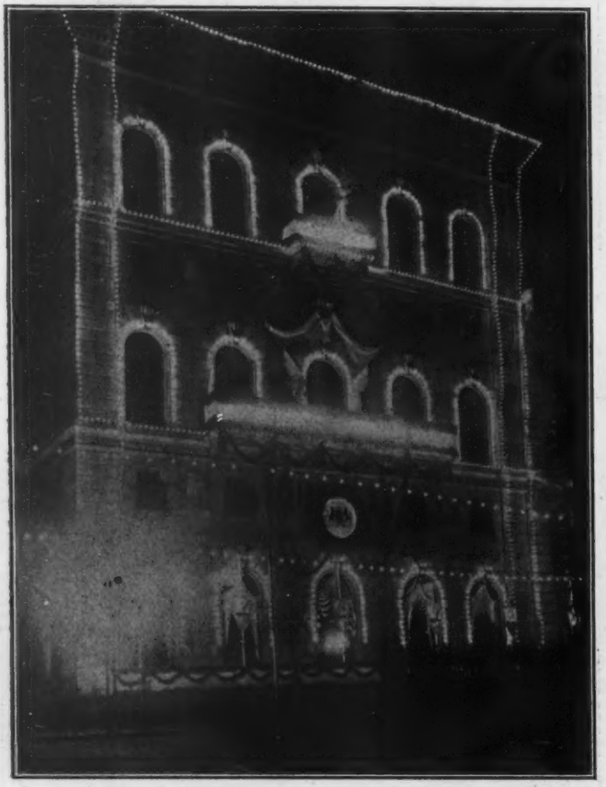


FIG. 10.—UNIVERSITY CLUB, NEW YORK.

there is another display of color and light. The two huge pillars of the water gate are snow white in the blaze of light at this point from which naval officers and attachés put out to the ships at anchor in the river.

At various points along the river and on the bay lighting of special interest is visible. On the Shore Road, which skirts the bluff on the Brooklyn side from Fort Hamilton to Owl's Head, three large electric signs are visible. Facing New York Bay is a sign consisting of the American and Hudson-Fulton flags crossed and the years "1609-1909." The flags are in colors and are 25 ft. long, there being 900 lamps in the design. Farther along the road is a sign reading "Welcome" in 12-ft. letters and a huge flagstaff at this point is outlined with lamps. At Owl's Head the Edison Electric Illuminating Company of Brooklyn has erected a sign with 20 ft. letters reading "Brooklyn Edison" in front of its generating station at that point. In the bay the Statue of Liberty is also ablaze with lamps around the pedestal besides the usual torch and presents a magnificent appearance.

On the Jersey shore of the Hudson the Hamburg-American Line and the North German Lloyd have decked the ends of the six piers with 6000 lamps. The former company has its coat of arms and streamers outlining its three large piers at Hoboken and the latter company has the same style of decoration with the addition of the American and German flags in incandescent lamps. The Holland-American Line has the same style of decoration as the Hamburg-American Line and uses 1500 lamps. The various amusement parks on the Palisades are also making quite an elaborate display.

One of the most striking electric signs in the vicinity of Greater New York is the well-known Colgate clock sign in Jersey City. This sign, which is observed by the multitude crossing the Hudson River ferries every day, has been remodeled especially for the Hudson-Fulton celebration, the main feature of novelty being a "life-size" representation of Henry Hudson's *Half Moon*, with waves dashing against it and flags fluttering in the wind. The magnitude of the remodeled sign is shown graphically in the accompanying view, giving the night appearance of the ship with the whole effect

FIG. 11.—SOLDIERS AND SAILORS' MONUMENT, RIVERSIDE DRIVE.

turned on at once. In actual operation the words "Colgate 1806" and the clock, made up of 1000 4-cp lamps, are flashed alternately with the ship and the date 1609, made up of 5000 4-cp lamps. The size of the two-way oil-immersed flasher installed may be appreciated when it is stated that two barrels of transformer oil are required to fill it.

The running rigging of the ship consists of "stringers"—a simple pair of wires, with receptacles connected on 10-in. centers. The shrouds, or ratlines, on the contrary, are of "trough work," as also are the other lines of the design—this construction holding the light localized. The brightness of the whole sign is enhanced by the use of plain lamps with blue, amber and red color-caps. The inside of each trough is painted the same color as the color-cap, so as to reflect only that color. The detail flashing of the ship is by a method giving a good imitation of the motion of the waves and the flapping of the

flags. There are always three adjacent lamps burning and the fourth one extinguished, and this effect progresses from the staff to the free end of the flag. The second row of lamps is staggered, and in it the wave is made to lag behind the wave in the top row; and so on down the vertical width of the flag. The lamps are not arranged in vertical rows, one above another, but in parallel rows following curved lines struck from the common center. This gives the natural slanting wave to the flag. Other refinements in wiring and flashing are the producing of a short wave of the flag near the staff, winding up with a long wave at the end of the flag.

The same wave motion obtained by this method of flashing is applied to the representation of the to-and-fro motion of a pendulum actuating the clock that forms part of this sign. The pendulum consists of a stem and a bob. The figure of the stem (which is three lamps wide) and of the bob (which contains 31 lamps) is in effect moved to and fro across the travel of the pendulum by the operation of the flasher. Thus in the stem, three lamps are always glowing, one being lighted ahead, in the simulated swing of the pendulum, just as the one in the rear is extinguished. The lamps, of which there are 388, arranged on 10-in. centers, are cut in and out of circuit in such a way as to progress the figure of the pendulum from one side to the other. The complete sign is 200 ft. long by 50 ft. high and contains about 5000 lamps. The clock face is 38 ft. in diameter and the name of the manufacturer occupies a space 160 ft. x 20 ft. The dates are in 11-ft. figures and the ship is 58.7 ft. long on the water line and 78.9 ft. long over all.

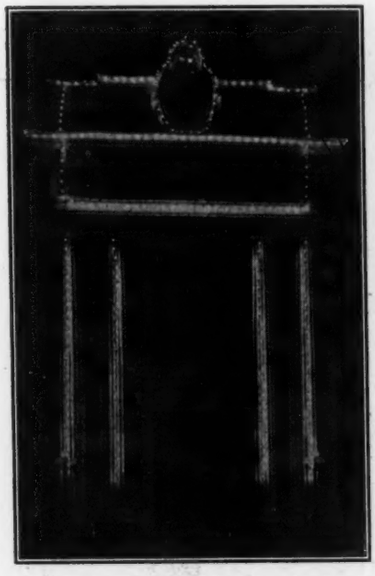


FIG. 12.—DIME SAVINGS BANK, BROOKLYN.

FIG. 13.—TEMPLE BAR, BROOKLYN.

FIG. 14.—BROOKLYN EDISON COMPANY'S BUILDING.

FIG. 15.—BROOKLYN AND MANHATTAN BRIDGES.

One of the most brilliant displays in the entire city was the illumination of the New York Edison Waterside station at Thirty-ninth Street and the East River. Every portion of the huge station was outlined and even the chimneys were enhanced by spiral lines of light.

GENERAL ILLUMINATION IN THE CITY.

During the celebration Fifth Avenue vies with Broadway as a new "White Way." The two continuous lines of lamps supported over the sidewalk light up the thoroughfare brilliantly. Towering high above Madison Square the lofty spire of the Metropolitan Life Insurance Building may be seen for miles. The 26-ft. dial of the clock is illuminated, together with the 17-ft. hands and 4-ft. figures, and every room in the 46 stories is a blaze of light. Not a shade is drawn at night and each room is lighted so that the massive tower stands out prominently. Surmounting the tower, more than 700 ft. above the ground, is a ball radiant with electric light. At the northern end of the Fuller Building at Twenty-third Street a model of a Dutch windmill is set up. The sails, bright with light, revolve slowly and by their beams a typical Dutch house can be seen behind a grove of trees.

A number of stores have marked out on their arcades large squares of light, but the Holland House is more elaborately decorated. Colored lamps are fitted to the corners of the structure and over the entrance blazes a large red and blue star, and the front is festooned in white lamps.

The Waldorf-Astoria has long chains of lamps arranged in the form of a pyramid and across the street the Knickerbocker Trust Company's handsome structure is shown off to advantage. The same is true of the Gorham Building. Tiffany's, across the avenue, features a clock surrounded by several hundred lamps arranged in floral design. The Union League Club, the Union Club, the Democratic Club and the University Club are all outlined and decorated. From between the towers of St. Patrick's Cathedral is suspended a large electric streamer. The Plaza Hotel emphasizes its graceful lines by lamps. Between the windows from above the fifteenth floor strings of lighted incandescent lamps are suspended and behind them shines the white marble walls. On the roof the *Half Moon* and other appropriate designs are outlined in colors. The Netherland Hotel is also outlined and a number of private residences.

On Broadway every restaurant and theater is lavishly bathed in light. The Knickerbocker Hotel, with its curious cornices

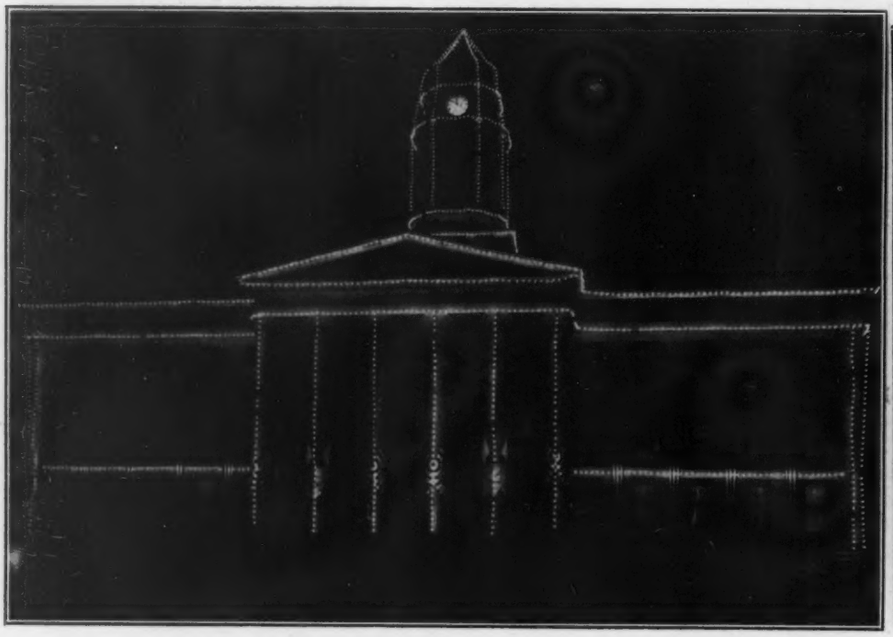


FIG. 16.—BOROUGH HALL, BROOKLYN.

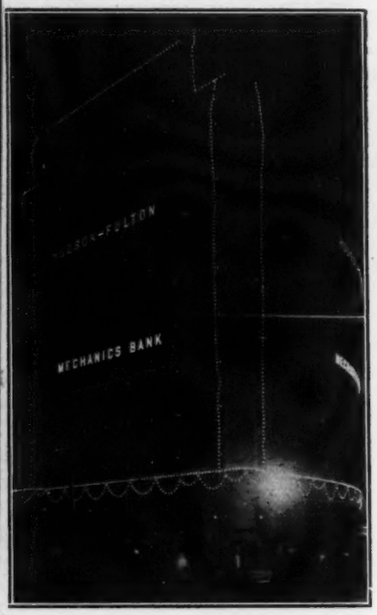


FIG. 17.—MECHANICS' BANK, BROOKLYN.

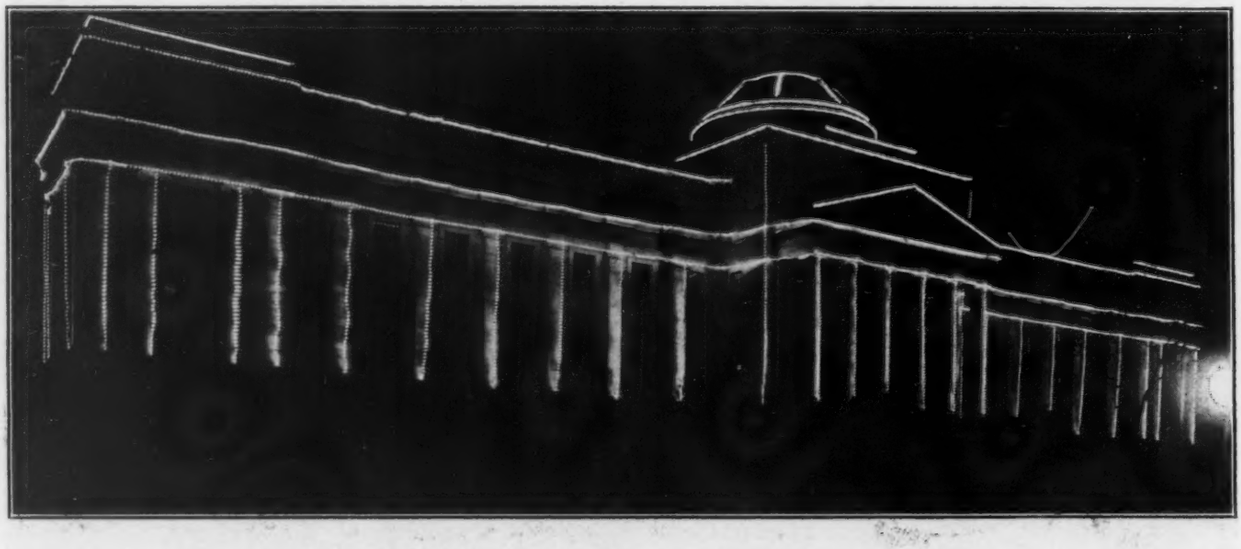


FIG. 18.—BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

and quaint pinnacles, makes a striking appearance, but not more so than the Hotel Astor with its front hidden beneath masses of green foliage. The evergreen mingles with string upon string of incandescent lamps and the balcony at the third floor is hidden by the prow of a copy of the *Half Moon*. The

Copyright, N. Y. Edison Co.

FIG. 19.—TOWN HALL, JAMAICA.

boat projects from the wall of the building and extends over the street about 30 ft. Electric lamps outline the hull, rigging and mast. The new grand ballroom in the hotel was lavishly decorated for the banquet, which took place there on Wednesday night.

Many of the large apartment houses and office buildings are making their presence known by means of electric lamps. In Brooklyn the Edison Company has lighted a number of sky-scrapers around the Borough Hall, notably the Temple Bar and the Mechanics' Bank Building. Its own office in Pearl Street is outlined with light and makes a handsome and striking appearance.

The week beginning Oct. 3 will be devoted to celebrations in the Hudson River towns above New York City. On Monday, Oct. 4, there will be celebrations at Yonkers and Poughkeepsie.

Copyright, N. Y. Edison Co.

FIG. 21.—TOWN HALL, FLUSHING.

Tuesday exercises will be held at Nyack and at Kingston. Catskill will be visited on Wednesday, and on the same day Tarrytown will hold its official celebration. Hudson will act as host for the fleet on Thursday, and Friday the fleet will reach Albany. Peekskill will celebrate on Friday also, and on Saturday the fleet will reach Troy. On Oct. 1 the naval parade will start from New York for Newburgh and the celebration in New York City will close with a carnival on the evening of Oct. 2.

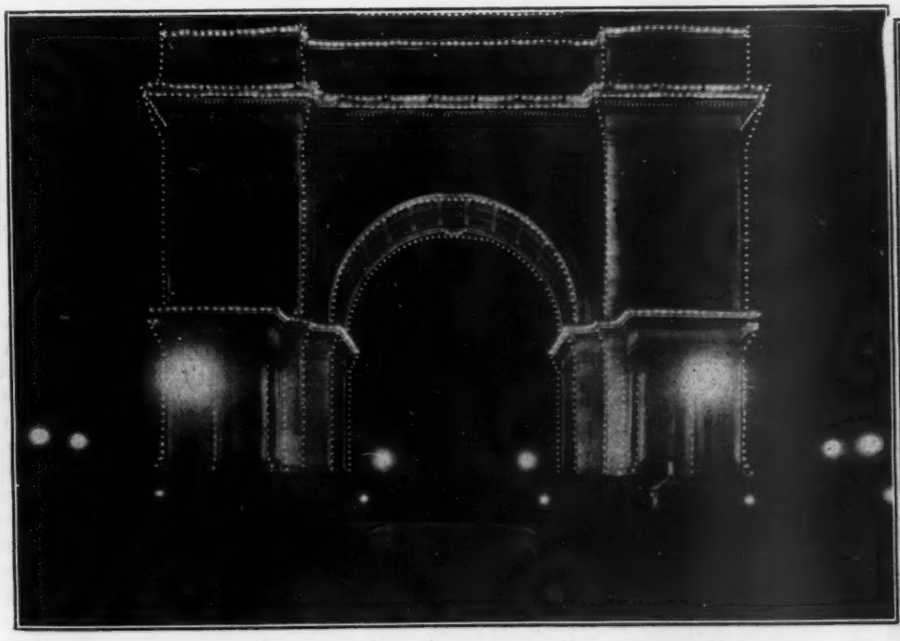


FIG. 20.—PLAZA ARCH, ENTRANCE TO PROSPECT PARK, BROOKLYN.

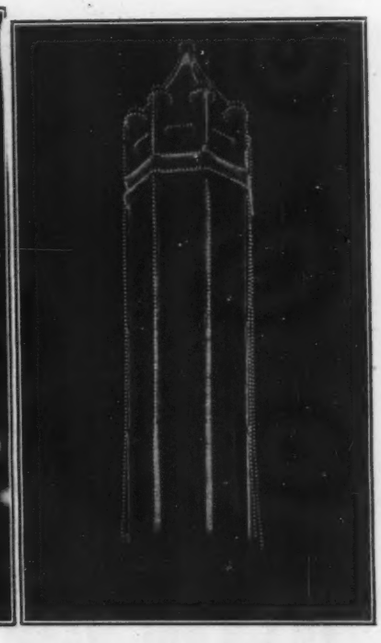


FIG. 22.—WATER TOWER, BROOKLYN.

Some Casual Remarks on Dampeners.

By Warren H. Miller,
Electrical Engineer, Standard Oil Company.

LIKE most subjects in which but very little is really known and settled upon, the battlefields of the dampener question are still lurid and sulphurous, and bid fair to remain so until shall ensue that holy calm which only broods

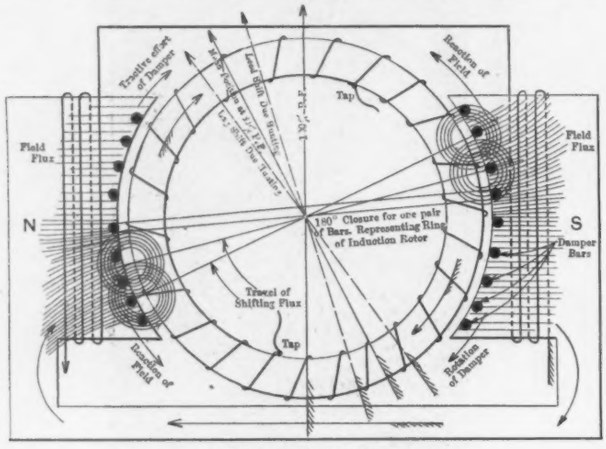


FIG. 1.—ACTION OF ELEMENTARY DAMPER.

o'er the stricken field when all the bewhiskered combatants are dead.

Briefly stated, the *casus belli* is as follows: Given an alternating-current generator or synchronous motor with a revolving field whose prime mover has a tendency to hunt, lag and overtravel, such tendencies will not only distort this field, but displace it mechanically from the true position of synchronism.

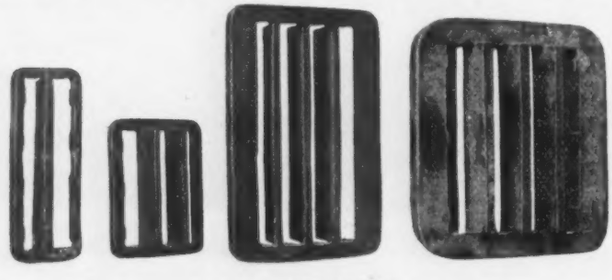


FIG. 2A.—GRID DAMPERS.

As this impulse is oscillatory and cumulative, what will be the best means for providing an electrical discourager, so to speak, of these tendencies to fly off the handle?

Obviously something placed on the pole-piece, in which currents would be induced by any change or distortion of the lines of force, will resist such changes, as its current will always be counter-active. This thing has a name, and many queer shapes, wild visions of demented brains, almost more weird than those strange, tortured cries published in current literature as "magazine poetry." The French call it an amortisseur or deadener; we name it a dampener or damper.

There is no questioning the efficacy or utility of the damper, and its importance is at present vastly increased in view of the rise of the large gas engine as a prime mover for alternators. For, in the present state of the art of governing gas engines, parallel operation is nowhere really satisfactory—compared to a first-class steam-engine plant with flywheel governors. Plant after plant tells the same story—ammeter and wattmeter needles swinging like pendulums, continuous overtravel and lag of governors, generators hot on half loads under heavy cross-currents traveling from one alternator to the other to pull them back into synchronism. These currents are *not* wattless as some would fondly imagine; they are real energy expended alternately on each machine, the fast one trying to bring the other up to its speed and in doing so slowing itself down so that it in turn becomes the slow machine. This action is oscillatory, as the flywheel becomes the reservoir of these impulses; and, unless the governor is prompt to interfere and dampeners are present, it is only a question of time when the two machines will throw each other out of step. With three machines in parallel this action becomes less violent, and with four still less so. With governor and flywheel properly designed so as to play into each other's hands, and dampers on the pole-pieces further to deaden any tendency to hunt, parallel operation becomes satisfactory and desirable.

But at present gas engine governors are far too sluggish to give anything like the practice of good Rites or other types of steam-engine flywheel governors, and two of the largest gas-engine manufacturers, recognizing this defect in parallel operation, are already in the field with a time-cut-off mixing valve which renders the governing far more prompt and efficient. The other aid to good parallel operation is the electric damper. It has been used for years and found indispensable in operating rotary converters, which are exceedingly prone to hunt. There are some 600,000 kw of these rotaries in New York City alone provided with dampening devices. Their use on slow-speed Corliss engines has been comparatively undeveloped, and on high-speed engines not at all, as there is no need; but on gas-engine units they have proved of great value wherever introduced.

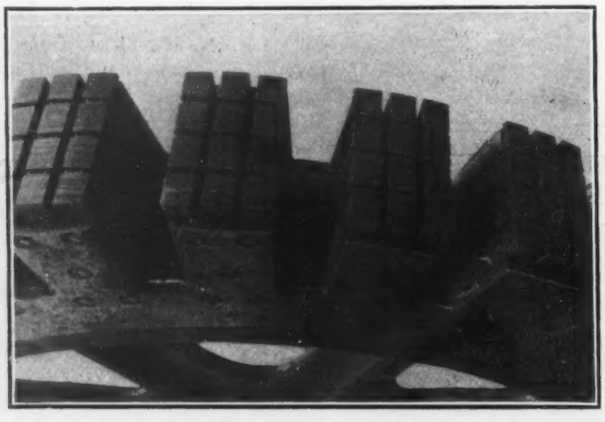


FIG. 2.—POLE-PIECE SLOTTED FOR DAMPER GRIDS.

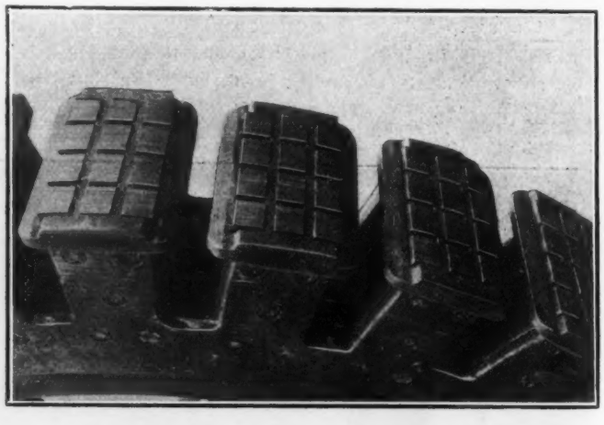


FIG. 3.—GRID DAMPERS IN PLACE ON POLE-PIECES.

Fig. 1 shows the action of a primitive damper. In a three-phase machine with 100 per cent power factor there is no tendency at all on the part of the armature to disturb the existing magnetic flux, which is, of course, the resultant of the field and armature flux acting approximately at right angles to each other, but at any leading power factor there is always a component, dependent on the angle of lead opposing the field flux and tending to crowd it over to one side. With a damper on the pole-piece, currents are at once set up in the damper if any

change is thus made in the field flux which counteracts this distortion and forces the field flux to remain practically as before the disturbance. Further, if these currents are given direction parallel to the revolving shaft, the currents flowing in the damper will also cause instantaneous rotation of the field pole itself in a direction opposite to the acceleration and thus tend mechanically to resist displacement of the field pole.

Now observe how beautifully these two theoretical phenomena are provided for in practice in the field of damper designed by the various combatants. Knight No. 1 vows that neither theory is worth a whoop, mounts his hobby and spurs into the arena with *his* damper, which turns out to be no damper at all, just a plain steel pole-piece in which eddy currents are set up. It works all right, but the temperature of the poles reminds you of John Chinaman's way of roasting a pig by burning his house down. He swears there's nothing the matter with it, though, but if you turn your back he will fill the shoe full of copper rods to give the eddy currents something to take hold of, and if you kick at the ventilation he will cheerfully bore it full of radial holes for you.

Knight No. 2 just puts a plain copper shoe on the pole-piece. It may bother him some to keep it there and the magnetic flux has to hunt for fresh air to get into the stator at all, but he is sure to hatch out a proper crop of "eddy currents" when the engines surge, so he speaks contemptuously of the steel-pole caitiff and bowls him out of his saddle. Knight No. 3 is content with a copper collar 2 in. thick around the pole-pieces. It doesn't worry him at all that this copper is 'way off at the edge of all the really important lines of force and has no iron back of it to provide a magnetic conductor—the flux is the thing, man, he argues, and he has *that* cinched in the middle of the pole-piece where it can't be distorted! So he lays about him lustily with this invention, and the other two varlets flee for

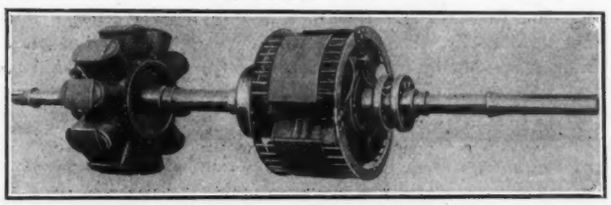


FIG. 5.—AMORTISSEUR WINDING APPLIED TO MOTOR-GENERATOR SET.

their lives and are later overtaken by the vengeance of God for their sins.

And now enter the lists the two heavy-weights. They have given this damper question some thought and have, forsooth, built all the known dampers at present in existence that anybody ever heard of. Ye knighte of the copper collar retires under the grandstand to think out how he's going to hold his collar on with no head atop of it, and we now have heralded dampeners that *are* dampeners. Figs. 2, 3 and 4 show very clearly the admirable construction of the Westinghouse dampener; Figs. 5, 6 and 7 that of the General Electric. You see at a glance they are considerably at variance. One company has thrown the induction rotor idea to bosh and scorn and is going in strong for field flux anti-distortion alone. The other sees your field distortion *and* the "eddy currents," and goes you a complete squirrel-cage rotor better!

Poor purchaser! Here are five valiant knights, each on his own hobby, all riding at him at once. He is told with considerable warmth by the engineer of each company that "those other fellows" have been filling him with hot air, not to say downright heresy, and he is given no credit at all for doing any of his own thinking. He eats a dinner with all of them in turn, and boils down all the facts which he marshals and numbers and sets out in a row as follows:

1. The best anti-hunting device is one that will always *drag* behind any sudden change of rotation.

2. The best electrical device to do this is the rotor of a squirrel-cage induction motor because it always lags behind a rotating field. At synchronism it does no work. The more it slips the greater its torque.

3. The best rotor for a squirrel-cage induction motor is the one which gives the induced currents direction parallel to the rotating shaft, and the more subdivided within well-known design limits, the better is its effective torque.

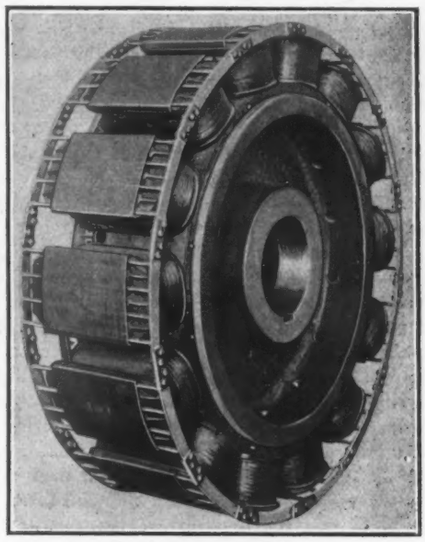


FIG. 6.—AMORTISSEUR WINDING FOR GAS-ENGINE GENERATOR.

4. Each rotor bar must have 180 electrical degrees of closure in order to enclose the maximum lines of force. This can only be done by a complete short-circuiting ring at each end, so that any given bar can have a continuous circuit to and through the corresponding bars on both adjacent poles, thus getting 180 electrical degrees of closure each way.

Now, while other considerations affect the ideal rotary converter dampener, for gas engines in parallel the above facts admit of no modification. If one engine's governor gives it too much momentary power, it speeds up, and its frequency and that of the other machine instantly rise above synchronism. Both dampers are now dragging behind the three-phase rotating fields in the stators (don't confuse this with the revolving-field pole-pieces), and, the greater the acceleration, the stronger the drag of the dampers. The momentarily fast machine, having spent so much energy in trying to bring up the other, becomes in a few seconds the slow machine itself, and drops below synchronism, taking the other machine electrically with it. Both dampers are now too fast and strive to go after their respective stator fields, with the result of pulling them back to

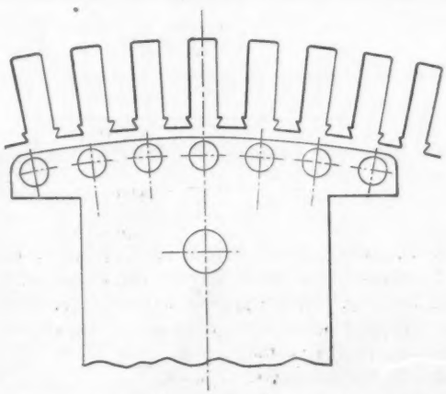


FIG. 7.—AMORTISSEUR FOR 500-KVA MACHINE.

speed, since the damper is tied to the engine and takes the engine with it. No matter what the disturbance, whether change of gas, backfire or premature, too much governor or too little governor, a big motor going on or off the load, the damper is always "agin'" it, like the unreconstructed Confederate soldier.

For maximum anti-hunting power, then, the damper design which most nearly approaches an ideal squirrel-cage rotor is the best. If a copper grid is used, conducting wedges, well-machined to provide good electric contact, are an absolute necessity, or else the two inner bars of the grid are practically worthless since they neutralize each other in one position, and have no complete closure in the other. The man with the copper collar has a very primitive rotor, practically without short-circuiting rings on the ends, and the parties with copper shoes and steel pole-pieces have gone still further back, almost to the copper cylinder of the original induction motor, which was very feeble and prone to heat owing to absolutely undirected induced currents and exceedingly poor magnetic flux. One can dismiss these types as primitive, except that the permanence of the steel pole will cause it to be heard from again in the paralleling of alternators.

There, then, remains the grid and amortisseur types of dampeners. While the amortisseur is undoubtedly the ideal, the strong construction and good ventilation of the grid type will always make it a formidable competitor, since the interpole wedges, if well machined, will give in effect a continuous short-circuiting ring for the bars of the rotor. It also permits of easy removal of the field coils, and, of course, by putting in somewhat more copper than with the amortisseur design one can secure an equal quantity of mechanical dampening effect. Regarding the effect of the damper in neutralizing the back ampere-turns due to strong armature reaction, the grid type possibly accomplishes this better than the armotisseur, but a careful consideration of its action will bring you right back to an elementary pair of bars of a squirrel-cage rotor. What is wanted in gas-engine paralleling at present is something mechanically strong to assist the governor and flywheel of the gas engine to resist the disturbing effects of change of gas and load, and above all to smother out periodic hunting. Specifications for gas-engine-driven generators are usually drawn calling for 2 per cent regulation from no load to full load, and a maximum of not more than 2½ electrical degrees of displacement of the pole-piece from either side of mean position of synchronism.

Now, the gas-engine builder can easily fulfil both of these conditions, and yet the paralleling may be wretched. In a machine of, say, 500 kw, a 60,000-lb. flywheel at 150 r.p.m., will provide ample rotative steadines for even 60-cycle work, and the 2 per cent regulation is largely a matter of getting the engine big enough, and a little more. But when two engines fulfilling both these conditions are put in parallel, the usual result has been, to date, continuous hunting over a considerable range on either side of synchronous speed, the ammeters of both machines swinging restlessly up and down the scale, stopping at brief periodic intervals at the true load current for the output, and the wattmeters weaving uncertainly across the load-point, varying about 35 kw on either side of a 100-kw load. The generators, running at half load, are hotter than they should be at full current, and the station men prefer to run the machines separately, and will run them separately if there is any possible combination on the switchboard which permits them to do so. They do not dare load the engines up, experience having taught them that any disturbance on the line, such as starting up some large motor, is quite likely to throw them out of step, if well loaded, and shut down the plant.

Obviously this is poor paralleling, yet the engines fulfil both regulation guarantees of the specification. The cause is simple enough. If you shut down the generators you will very probably find the pole pieces provided with some very primitive type of damper, or else a simple interpole copper wedge. The designer either has not calculated his damping effect (which can easily be done by the well-known laws governing induction-motor design) or else he has been unwilling to sacrifice a little efficiency, with the result that the machines are sacrificing something like 25 per cent of their output to hold each other in step. And the prime cause of it all is almost invariably too sluggish a governor. The control must be prompt, strong and able. If there is a change in the load, or in the gas, or a backfire, the governor must be quick to readjust the quality and quantity of the mixture. It will not answer to let the governor do this three or four strokes after the change. By that time the flywheel has slowed down or speeded up, and altered the governor out of all proportion to the disturbance, with the result of corresponding overmuch admission of gas and undue acceleration. The other machine, of course, has to bear the brunt of this, hence the surging, as precisely the same overtravel of governor follows on it. The gas and air must be varied right at the inlet valve and it must not be done by sliding ports which will wire-draw the gas at light loads, but by complete opening of both air and gas ports, the *time* of which can be varied by the governor, so that the gas and air are always placed in the cylinder without being disturbed by any change in the shape of the orifice. The amount of the charge is determined by the time of cut-off, which is varied to suit the load by the governor.

This form of valve gear has already been put on the market for alternators in parallel by two of the largest gas-engine manufacturers in the country, and, assisted by powerful dampers on the pole pieces and a correct proportion between armature reaction and field strength, should enable us to run gas-engine stations in parallel with the clock-like smoothness of any good steam plant.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

"Seeing Denver" Illumination.

By C. H. Stannard.

Denver is, as *Electrical World* readers know, termed the "City of Lights," this name having been suggested by Mr. Henry L. Doherty. At the present writing, Seventeenth Street is being equipped with eight constant potential arcs to the block, similar to the installation recently made on Fifteenth Street and Sixteenth Street.

This addition to Denver's street lighting, in connection with the many new electric signs, has brought our city into such prominence as the "City of Lights" that one of the "Seeing Denver" companies, operating large "Seeing-Denver" auto cars having a seating capacity of about 30 passengers, has found it to its advantage to inaugurate a night service, the object in view being to show Denver as the "City of Lights," giving tourists and others a splendid opportunity of seeing what has been accomplished by the Denver Gas & Electric Company in developing its window, sign, display and street lighting.

It is particularly interesting to observe that many people are glad to take advantage of this opportunity, which makes it on the part of the "Seeing Denver" Company a most popular enterprise.

One noticeable feature of our sign lighting is the fact that there is no danger of a tourist going out at night expecting to see some specially attractive sign, and finding it dark, for the reason that all signs are on the flat rate, burning from dusk until midnight, and some of them all night.

When we explain to our sign prospects that tourists are taking such an interest in viewing our night signs, we find that the prospect is much more easily approached in connection with installing a sign than before this evening service was inaugurated.

Wallingford (Conn.) Municipal Plant.

The report of Superintendent A. L. Pierce, of the Wallingford, Conn., municipal plant, for the year ending July 31, 1909, shows an income of $29,751 and operating expenses of $18,205. Five per cent appreciation and 5 per cent capital charge were charged off on a total investment of $79,976. Further deductions were made on account of incandescent lamps ($2,891), arc lamps ($228), automobiles ($250), etc., aggregating $3,528, the net gain being $15.50. The present total valuation of the plant is $121,559.

The total capacity of the steam and water-power plant is 505 kw, that of the former being 385 kw and of the latter 120 kw. The total connected load is equivalent to 15,000 16-cp lamps. The total output was 490,055 kw-hours, of which 59 per cent was generated by steam and 41 per cent by water. Electric irons to the number of 160 are in use, and 70 motors. The basic residence rate is 10 cents per kw-hour, but if 35 per cent of the lamps connected are used two hours or over daily, the rate is reduced to 8 cents. The flat rate for sign lighting is 9 cents per month for 2-cp lamps and 16 cents for 4-cp lamps. In case connections are made to a building with an isolated plant, there is a standby charge of $5 per year per kilowatt of transformer installed, and the rate for any current used is 10 cents per kw-hour.

Useful Figures from Practical Power-Plant Operation.

Mr. P. H. Palmer, of the Kokomo, Marion & Western Traction Company, Kokomo, Ind., read an interesting paper entitled, "Central Power-Station Practice" at the meeting of the Indiana Electric Light Association at French Lick on Aug. 18. Remarking that from 60 per cent to 80 per cent of the total cost of central-station lighting is traceable to the power station itself, Mr. Palmer said that an effort toward greater economy, particularly in the boiler plant, is well worth while. So far as coal is concerned, dealers' guarantees are usually based on ideal test conditions, seldom taking into account the numerous losses due to auxiliaries, condensation, etc., met with from day to day. This often accounts for apparently poor records of coal in the station.

In the plant with which the writer is connected there are two 1000-kw steam turbines, one being held in reserve. With a 27-in. vacuum and a 50 per cent average daily load factor, the feed water required is 30½ lb. per kw-hour. This consumption was found to be distributed approximately as follows: 24½ lb., or 81.7 per cent, to operate the turbines; 3.2 lb., or 10.7 per cent, to operate the condensers; 1.1 lb., or 3.6 per cent, to operate feed, tank and cooling-water pumps, and 1.2 lb, or 4 per cent, for moisture, condensation, leakage, blowing out boilers, etc. As will be seen, 18.3 per cent of the steam is not used by the generating units themselves. The curve of steam consumption for the turbine rises quite rapidly on very light loads, bringing the average to 24.5 lb. per kw-hour during the 24 hours. The efficiency of boilers and furnaces works out at 57.5 per cent—a fair average for an every-day result.

To obtain a higher evaporation, better grades of coal were used, but it was found that the improvement did not compensate for the increased cost of coal. The coal used is Illinois slack. In the matter of selecting coal it is difficult to make a definite rule. Apparently the central-station manager could afford to pay for coal in proportion to the heat units contained, yet some coals are exceptions to this rule and some plants are also exceptions on account of certain conditions. One can learn much about the combustion in his plant by testing for CO_2 in the different passes of the boilers. If the gases contain only 5 per cent or 6 per cent of CO_2 the manager has an opportunity to increase efficiency by trying different manipulations of draft and thickness of fires and stopping leaks in boiler settings. In buying coal there should be an investigation to determine definitely what is best for that particular plant. For one thing, it should be determined whether the coal deteriorates rapidly from exposure to weather in storage.

Direct-acting feed and tank pumps almost invariably consume a great deal of steam. In plants where the exhaust steam cannot be used in the feed-water heater, it will usually pay to use electric pumps for every purpose except boiler feeding.

In the engine-room intelligent and skillful help is needed as well as in the boiler-room. The engine-room attendants should not be kept steadily on the same shifts, but should be changed about so that each one will learn each "run" in the plant. Each man should be taught the value of observation and of records made from observation, which are the source of all improvements. He should be taught that power-plant daily records should be kept as correctly as the bookkeeping accounts in the office. Automatic devices should not be relied upon too much, but should be inspected at regular intervals.

The switchboard attendants should be taught to appreciate fully the value of uniformly correct voltage at the center of distribution. A pair of pressure wires connecting the secondary of a transformer carrying an average lighting load near the center of distribution with a voltmeter in the plant, is of great assistance in maintaining the voltage right with hand regulation.

In keeping the daily log sheet, the total load, at least in kilowatts, should be plotted in a curve. The daily log sheet should contain the principal records of station operation, but should not contain too many details. The total results of the boiler-room and engine-room should be kept separate, and in obtaining these the greatest difficulty is the accurate measurement of the feed water. This is somewhat simplified if it can be done before the water enters the heater, as hot-water meters are well known to be unreliable for continuous use, according to Mr. Palmer.

The writer gave some interesting comparisons of average economies effected during some of the stages of growth passed through by many stations. In a small lighting plant, furnishing 400 kw-hours to 800 kw-hours each night from belt-driven, simple, non-condensing engines and horizontal tubular boilers, the plant being shut down during the day, the cost per kw-hour, with $1.50 slack coal, will average about as follows: Coal, 1.5 cent; labor, 0.65 cent; lubricants, waste and miscellaneous supplies, 0.1 cent; repairs, 0.06 cent; total station operating cost, 2.31 cents per kw-hour at the switchboard. On the other hand, the large, well-regulated, modern station with well-developed day load, furnishing 40,000 kw-hours or more per day, with equipment operating at 70 per cent load factor, will produce a kw-hour at the switchboard for the following operating costs, using the same coal as in the case of the smaller station: Coal, 0.38 cent; labor, 0.13 cent; lubricants, waste and miscellaneous supplies, 0.01 cent; repairs, 0.02 cent; total, 0.54 cent, or only 22 per cent of the cost of the small station.

In the Kokomo station, which furnished an average of 12,083 kw-hours in 1908, a medium between the two cases cited is reached, the station operating cost being 0.72 cent per kw-hour. This is made up as follows: Coal, 0.47 cent; labor, 0.20 cent; lubricants, waste and miscellaneous supplies, 0.02 cent; repairs, 0.03 cent; total, 0.72 cent. This station has been improved by the addition of new equipment during the last three years, and a decrease in operating cost from 1.1 cent per kw-hour for 1906 to 0.72 cent per kw-hour in 1908 is due about equally to more efficient equipment and to increased output.

In this particular plant the cost of conveying coal and ash by mechanical means would be about 5 cents per ton. Doing this work by hand costs 12 cents per ton. The changes in the equipment of the plant so far made have reduced the steam consumption from 42 lb. to 30½ lb. per kw-hour. The principal change was the replacing of reciprocating, direct-connected condensing engines by turbo-generators and jet condensers.

In some plants it is deemed desirable to generate alternating current only and convert to direct current in order to maintain

an already established direct-current power service. Mr. Palmer said that the loss in his company's motor generators and storage batteries operating with a 40 per cent load factor and supplying railway energy is 32 per cent.

It is often good policy in making changes in equipment to utilize some of the old equipment for short-hour peaks and for reserve, providing this equipment is reliable. In order to cancel a 12 per cent interest and depreciation charge on a $50 investment per kw-hour installed for improvements, a saving of 0.82 cent per kw-hour would have to result from the investment if the equipment were only operated for an equivalent of two hours at full load each day. If this equipment should generate enough energy each day to equal its full load for 10 hours the saving required to cancel the interest and depreciation would be reduced to 0.16 cent per kw-hour, and 24-hour, full-load service would reduce this required saving to 0.07 per kw-hour.

In discussing this paper, Mr. Fred Leslie, of Muncie, Ind., asked for a comparison of Indiana screenings and Indiana mine-run coal in plant operation. Mr. Palmer answered that the latter gave an increase of 5 per cent in evaporation, but the difference in price more than overcame this economy. Mr. C. C. Perry, of Indianapolis, called attention to the fact that the figures given covered only station cost and not interest, depreciation, administration and other overhead expenses which must be added in determining the true cost of producing electrical energy by the central station.

Increasing the Central-Station Profits at Geneva, Ill.

The central-station situation at Geneva, Ill., is specially interesting for two reasons. This station, which is municipally owned and combines electric light and water-works service, is now giving all-day electric service and pumping city water for a lower fuel bill than before the introduction of the day electric service. The day service resulted in taking on a motor load of single-phase, 133-cycle motors amounting to 87 hp connected and the motor service is as satisfactory as in any plant of this size.

In the summer of 1908 the electric plant was being operated at night only. The water works were operated continuously because of the possibility of fire and the limitations of the pumping apparatus. The conditions as regards water pumping were fatal to economy. To lift water but a few feet out of a deep well an air compressor with 14-in and 16-in. cylinders by 16-in. stroke was operated. This air-lift system was installed because of the mistaken idea of those previously in charge of the plant as to the requirements. As is well known, the air lift is not an economical method of raising water from a well. There are many cases where its use is proper because it increases the output of a well over and above the output which could be obtained with a deep-well pump. It also has the advantage of requiring no moving machinery in the well, as does a deep-well pump. However, the well from which the Geneva water works is supplied has the water so near the surface when being pumped that the use of the air lift is unnecessary.

The operation of this large air compressor for such a short lift seemed so obviously uneconomical to Mr. Olof Peterson, the superintendent of the plant, that he began to investigate by pumping from the well with one of the boiler-feed pumps to determine the amount the water would be lowered if the well were pumped continuously at a rate sufficient to supply the city. As a result, he found that the water remained within easy suction reach of a pump placed at the surface. This indicated that the water might be pumped much more economically by a small power pump taking by suction from the well and discharging directly into the mains against standpipe pressure. The air lift was discharging its water into a surface reservoir, from which the water was pumped by a compound, non-condensing direct-acting Dean steam pump, 12 in. x 18½ in. x 11 in. x 18 in., which is much too large for ordinary requirements.

About this time the people of Geneva began to ask for day electric service. Mr. Peterson realized that to add this service and continue the existing water-pumping conditions would be to add much more to the operating expenses of the plant than would be added to the gross receipts. He reported to the Mayor and Aldermen, however, that if it could be arranged to change the ordinary pumping of the city water to an electrically driven power pump operated 20 or 24 hours per day, the plant would probably run on the same or less coal than the two plants were then consuming with the electric plant operating nights only. The electric generating plant contained 133-cycle, alternating-current apparatus. The usual objection was raised by several electrical men who were consulted that 133-cycle apparatus is not suited to power service. Mr. Peterson, however, learned of a number of single-phase plants operating 133-cycle, single-phase motors, and after a visit to Logansport, Ind., where a number of such high-frequency motors are in service, reported to the City Council in favor of the installation of a motor-driven pump for water-works service; the starting of 24-hour electric service to supply this pump, and whatever else was offered in the shape of daylight business. At that time the demand for motors was apparently secondary to the demand for day service for flatirons, fans and basement lamps. Inside of a year, however, a motor load of 87 hp was connected.

One of the most interesting facts in connection with this was the saving in fuel which resulted. For a period of eight months under the new arrangement the coal bill was $300 less than for the corresponding months of the previous year, using the steam-pumping machinery. The results, therefore, prove that Mr. Peterson's estimates that the day service would be operated for the same amount of coal were very conservative. The reason for the saving is the economical use of steam in the automatic cut-off engine used for driving the electric generator as compared to the uneconomical use of steam in the large air compressor and large fire-pressure pumps, plus the wastefulness of the old methods of pumping by air lift.

The pump which now does all the water-works pumping except in case of fire, is a triplex 6-in. x 8-in. Dean, with a capacity of 150 gal. per minute. It pumps direct from the well into the mains against standpipe pressure with a suction lift of 19 ft. and a discharge pressure of 65 lb. It is driven by a 12-hp, 110-volt, 133-cycle Wagner motor, and during the summer is operated 20 hours per day. It has been steadily in service since installed. In order to get the necessary speed reduction a 60-in. pulley is placed on the pump and driven from a 9-in. pulley on the motor. As a 60-in. pulley would be likely to cause vibration of the pump if dependent upon the pump foundation entirely an outboard bearing has been placed on the end of the pump shaft, which carries the pulley.

The comparative size of the pumping machinery formerly used for every-day service and that which now performs the same service is an amusing example of what can be accomplished with the application of engineering knowledge to a problem of this kind. The steam pump formerly used had a daily capacity of 1,500,000 gal., as against 216,000 for the present electric pump, to say nothing of the air compressor which was operated.

As another result of the day service, 75 flatirons have been connected to the lines during the past summer.

Single-phase, 133-cycle Wagner motors have been connected as follows: City water, 12 hp; two sawmills, 10 hp and 25 hp, respectively; ice-cream factory, 3.5 hp; grain elevator, 7.5 hp; centrifugal pump, 10 hp; centrifugal pump, 5 hp; concrete mixer, 12 hp; printing plant, 1.5 hp; monument works, 5 hp; a total of 87 hp. An electric welding machine also uses 25 hp when operating. The day load at the time the writer visited the plant was fairly steady at 40 amp. At starting-up time morning and noon this load occasionally rises to 80 amp at 1100 volts.

The electric plant has been recently enlarged and now has

a capacity of 240 kw in alternating-current apparatus and one 45-light, 6.6-amp Wood arc-dynamo. The unit ordinarily operated to carry the day load is a 100-kw alternator driven by a Ball high-speed engine. A 60-kw alternator driven by a 50-hp engine is not usually sufficient to carry the day load. The last unit installed consists of a Ball engine of about 200 hp belted to a 120-kw alternator and the arc-dynamo. The boiler plant consists of two horizontal, return-flue boilers, 60 in. x 16 ft., and one boiler of the same type, 72 in. x 18 ft. The usual practice has been to operate two boilers continuously without regard to the amount of load to be carried.

The switchboard, which was built at the plant, was equipped with double-throw oil switches for each feeder and generator. In this way the load can be distributed between the generators. Each feeder has a watt-hour meter attached for measuring the output. There is one meter for each of the following services: City water pumping, constant-potential street lamps, series street arcs, direct-current and miscellaneous light and power service.

There are 45 6.6-amp, direct-current series arcs and 30 6-amp, 110-volt, constant-potential arcs for street lighting, making a total of 75 arcs, which indicates unusually good street lighting for a city of only 3000 population.

The accompanying table shows the kw-hour output for various purposes, and the coal consumed by months from Feb. 1 to Aug. 1, 1909. The switchboard watt-hour meters were not installed previous to this period. The coal consumed is taken from a record of the amount received with reductions for the amount apparently on hand at the end of each month. While this is not exact for any one month, for a period of seven months it is probably sufficiently accurate for practical purposes. In the case of July the actual coal consumption was estimated to be 366,270 lb., instead of 300,000 as given in the accompanying table.

COAL AND OUTPUT RECORD.

Month, 1909.	Total Coal, Pounds.	City Water Pumping.	Alternating-Cur. Arc.	Direct-Current Arc.	Commercial Light and Power.	Total.	Coal Per kw-hrs. lbs.
February	360,000	3,782	1,220	2,722	16,190	23,914	15.1
March	366,000	4,132	1,050	2,095	15,590	24,867	14.7
April	310,000	4,591	1,130	2,220	14,660	22,601	13.7
May	300,000	4,929	1,050	1,960	12,250	20,189	14.9
June	300,000	4,677	930	1,715	12,320	19,642	15.3
July	300,000	5,042	970	1,900	14,620	22,5 2	13.3
August	300,000	4,680	1,290	1,632	15,940	23,542	12.7
Total	2,236,000	31,833	7,640	14,244	101,570	167,487	
Average....							14.2

During this month, however, the air compressor of the water plant was operated temporarily to supply compressed air to the contractor for drilling in the construction of a new bridge near the plant. It has, therefore, been considered fair to deduct 66,270 lb. from the July consumption as chargeable to the air compressor, which makes the July electric plant consumption the same as the preceding and following months. Coal costs $2.58 per ton, delivered.

The plant is operated by one man, except during the first half of each night, from 6 p. m. to 12, when there are two men. The men work in 10-hour shifts. This requires three men for the entire operation of the power plant. There is one electrician for outside work in addition to the superintendent. No other men are employed. The books are kept by the city officers.

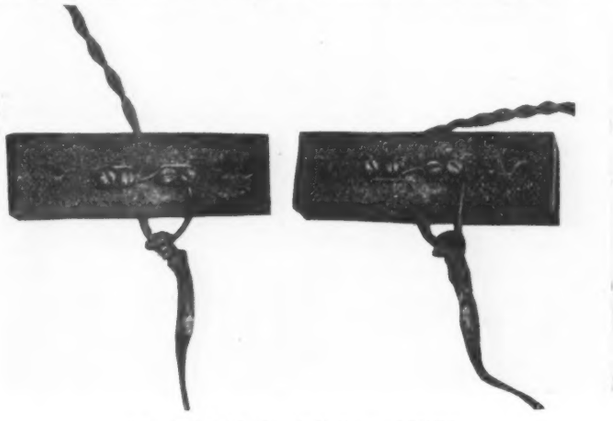
Meters are tested once a year, and all consumers are meter-connected. The city, however, allows free one lamp in front of each store for street-lighting purposes. The City Hall is also lighted without a meter. Including the electricity used on these unmetered lamps the percentage lost and unaccounted for is 25. The consumers' meters are tested in place with the use of a Westinghouse portable watt-hour meter.

The lighting rates are 15 cents per kw-hour, with a discount of 5 cents per kw-hour for payment before the twentieth of the month. The power rate is 5 cents per kw-hour, with a discount of 1 cent per kw-hour. The minimum bill is $1 per consumer.

INTERIOR WIRING AND ILLUMINATION

Old-Time Wiring.

The accompanying illustrations are reminders of the state of the electric wiring art in the early days of electric lighting. Above 100 of the connection blocks for pendant cords, which then answered the purpose of rosettes, were installed some 20 odd years ago in the Cheyenne Industrial Club Building, of



AN EXAMPLE OF OLD-TIME WIRING.

Denver, at that time belonging to the Cheyenne Club. The greater part of these are still in use and no serious fires have resulted. In fact, aside from some local scorching, so far as can be learned, there has been no fire, all of which goes to prove to some members of the club that the fire hazard of electricity is greatly overrated.

Denver Theater Electrical Installation.

An interesting stage equipment has just been placed in the Denver house of the Orpheum Theater circuit. This equipment was installed as a part of the general effort on the part of the management to assure its patrons of the safest possible conditions in the building. The stage is wired entirely in conduit with standard steel borders and foots and with continuous flexible feeds to the borders, which latter are supported by steel cables with strain insulators. The dressing-rooms are lighted by fixed lamps on the side walls, with the guards locked

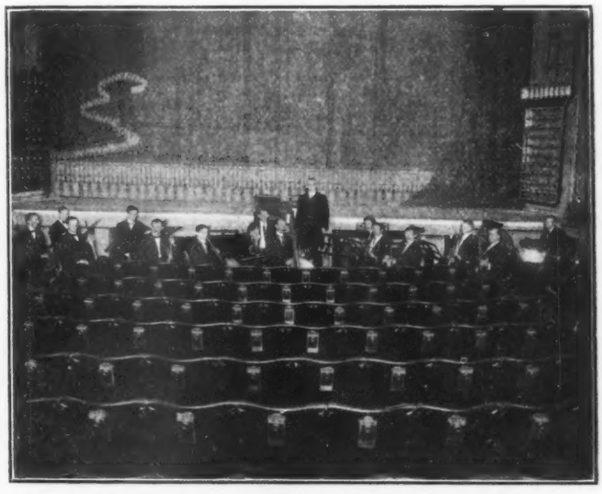


FIG. 1.—ORCHESTRA AND STAGE, DENVER THEATER.

to the receptacles. The signal circuits, including circuits to annunciating boards, are also run entirely in conduit and have an independent marble switchboard. This board also contains the signals to various parts of the stage and the general fire alarm of the building. The annunciator panel is of all steel construction, with the wiring circuit in conduit. All wires are soldered to the receptacle terminals. The stage boxes are watertight, and located under the stage, being connected through

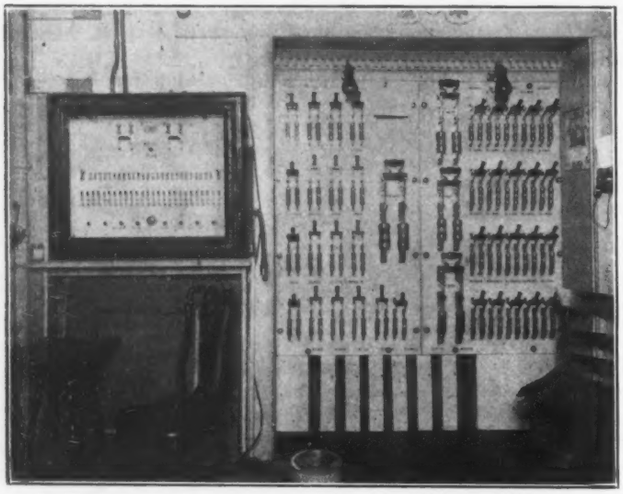


FIG. 2.—SWITCHBOARD, DENVER THEATER.

lead-covered armored cable to plugging boxes on the stage floor. The moving-picture booth, which is entirely of steel, has a skeleton of 2-in. angle iron and spring-operated shutters held open by fusible links.

This is the first of the older theaters in Denver to be rewired in accordance with modern construction methods. The signal boards and booth arrangements were designed and constructed by the Commercial Switchboard Manufacturing Company, of Denver.

Industrial Plant Illumination with Tungstens.

By Arthur Gillman.

In spite of their frailty and recent development, tungsten lamps are already used to a surprising extent for industrial-plant illumination. It would naturally be assumed that because of the fragile filament they would be unsuitable for shop and mill conditions, but advantages offered as to better light, economy, reliability, simplicity and convenience are so alluring that devices have been developed to protect the delicate tungsten filament against the jars and shocks incident to factory installations.

It should be understood that tungsten lamps are recommended for general illumination only, and then where the units can be located out of danger of contact with adjacent bodies and out of reach or in lock sockets. They are not recommended for specific illumination, such as that provided by bench lamps or lamps arranged around machinery on flexible cords. The carbon-filament lamp is best suited for these conditions. The best results for general illumination seem to be provided by the utilization of high-power lamps (250 watts) or the grouping of several lower-power lamps into a cluster.

In some instances it will prove economical to replace enclosed-arc lamps by the new rival, selling the old arc lamps for what they will bring. Certainly no new factory-lighting system should be installed without first considering tungstens. The average actual life of a tungsten lamp is in the neighborhood of 1000 hours. This means that under ordinary factory conditions, when used for general illumination, each lamp should last about a year without renewal or attention. Enclosed-arc lamps require frequent adjustment, trimming and repairs, each with its probable interference with production. Considering the cost of these items, cost of electricity consumed and interest on investment as against cost of electricity and any operating and annual charges for a tungsten-lamp installation, providing as satisfactory an illumination, it will be found that the yearly cost will be less with the tungsten lamps

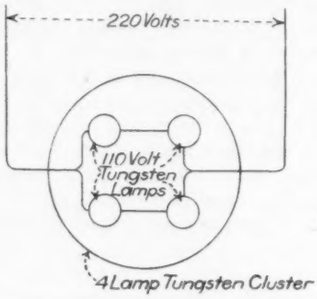


FIG. 1.—DIAGRAM OF CONNECTIONS.

than with the enclosed-arc lamps. On alternating-current circuits the low power factor inherent to alternating-current arc lamps is wholly avoided where tungsten lamps are used.

The flaming-arc lamp has its own field in the illumination of wide areas, where it can be located high above the plane to be lighted or for advertising. It is not suited to a majority of industrial-plant conditions where the ceilings or roof trusses are comparatively low. The function of this paper is to describe some methods whereby the difficulties inherent to tungsten lamps installed under factory conditions may be overcome and whereby these efficient illuminants may be made available for industrial-plant installations.

In plants where current at a tension of 220 volts is available 110-volt tungsten lamps may be wired across 220 volts two in series, as shown in Fig. 1. Manufacturers have for some time advertised as being prepared to furnish 220-volt tungsten lamps, but very few have been made and deliveries have been slow. Recent developments indicate, however, that the problem has been solved and that it will be shortly possible to secure 220-volt tungsten lamps with reasonable promptness. It is claimed that the 220-volt tungsten lamp has the same specific

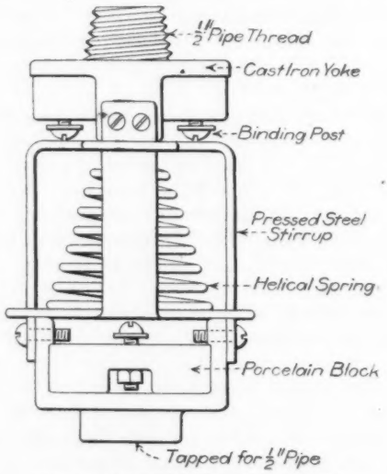


FIG. 2.—COMMERCIAL JAR ABSORBER.

consumption (1.25 watts) and life as the 110-volt lamp. It should be noted that the specific consumption of a 220-volt carbon-filament lamp is somewhat below that of the 110-volt and also that the useful life is shorter.

Local conditions determine whether, in designing a tungsten installation, clusters or single lamp units should be used. It costs less to wire for a few clusters than for, say, four times (assuming four-lamp clusters) as many single lamp units;

but if uniformity of illumination is essential, the latter scheme must be followed. Four-lamp clusters have gained much favor for factory lighting. Each is usually equipped with four 60-watt or with four 100-watt lamps. It is difficult to see why it would not be better from all standpoints—simplicity, economy and appearance—to use one 250-watt lamp with a suitable reflector than four 60-watt lamps. It is probable that the movement in favor of the four-lamp cluster started before 250-watt

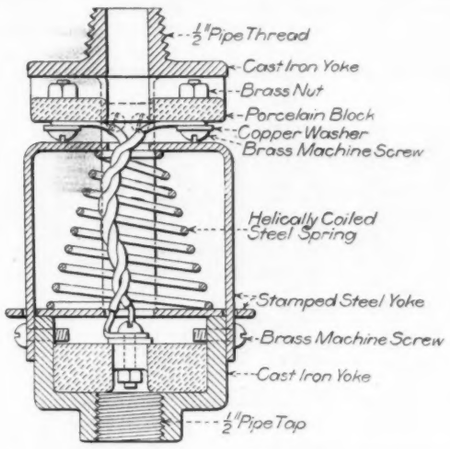


FIG. 3.—LONGITUDINAL SECTION OF JAR ABSORBER.

lamps were obtainable and that its inertia is carrying it forward. If 110-volt lamps are used on 220-volt circuits, a cluster is desirable to avoid complications in wiring. Arc lamps consuming 400 watts have been replaced by 250-watt tungstens equipped with prismatic glass reflectors and the illumination bettered thereby. As a general rule it is well to install as few lamps as possible, each of as high a power as conditions will allow.

When a tungsten lamp is installed in a location where it is subject to jars and shocks it must be hung from some vibration-absorbing device to insure against breakage. Anything that will prevent vibrations in the supporting member from reaching the lamp will do. If the disturbances are not excessive, a piece of lamp cord or a rope interposed between the lamp and its support will answer; but if sudden shocks occur a spring appears to be the only solution. A commercial device for supporting tungsten clusters in factory installations is shown in Fig. 2 and a section of the same appliance is given in Fig. 3. The weight of the cluster is taken by a helical steel spring under compression and the appliance is manufactured in four different strengths for supporting clusters of any weights from 4 lb. to 15 lb. In installing the "jar absorber" it is interposed in the conduit stem to the cluster and the leads to the cluster are clamped under the brass machine screws and washers mounted on the lower porcelain block. Electricity is conveyed by two conductors, carried in the length of conduit supporting the absorber, to the two binding posts on the upper porcelain block and thence, by a piece of duplex lamp cord furnished with the absorber, to the binding posts on the lower porcelain block. The spring is helically coiled with the small end uppermost to secure a maximum of resilience. The threadings at the two ends are for ordinary conduit and may be obtained for either ½ in. or ⅜ in. The device is 5 in. long over all and weighs about 1 lb. In locations where appearance is a factor the upper nipple can turn into a crow-foot fastened to the ceiling and the absorber concealed with a canopy. In order to conform to National Electric Code regulations an insulating joint should be interposed between the absorber and the supporting surface if it be grounded metal work or a plastered ceiling.

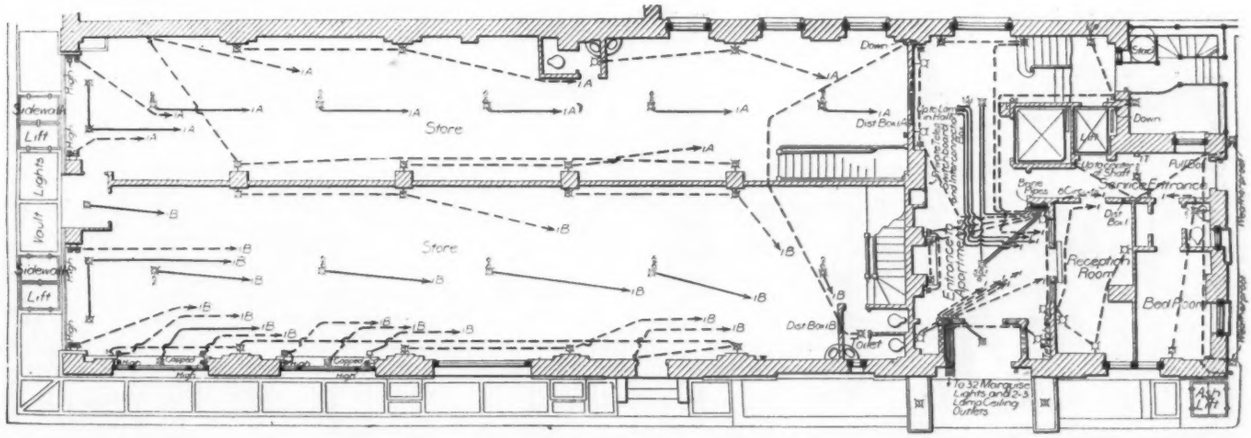
Wiring of High-Grade Apartment House.

BY N. M. SCHOONMAKER.

The apartment house recently erected at 636 Fifth Avenue, New York, stands as a type of the high-grade work which the city is getting in its new buildings. The old phrase, "all modern conveniences," has been stretched till it embraces service such as, even 10 years ago, it was not thought possible to get outside of the best hotels. Besides the usual conveniences, the owner of this new building supplies to his tenants an unusually elaborate system of telephones, a Holmes protective system, messenger calls, a clothes drier, a plate warmer, a refrigerated box, a vacuum sweeper and thermostat compressors in each apartment.

The ground floor of the building (Fig. 1) is taken up with two large stores which open upon Fifty-first Street, the main entrance to the apartments on Fifth Avenue, a reception hall and a bedroom for the use of the superintendent of the building. The basement beneath the stores is let with the stores, and is connected to them by means of stairways. There are also two sidewalk lifts, one for each store. The remainder of the basement, which is taken up with the laundry, lockers and toilets, is entirely cut off from the store basements. Excavation for the sub-basement was made only under a portion of the building, and here is located the boilers, tanks, pumps and main switchboard.

The Edison 240/120-volt service enters the building through the basement from Fifty-first Street, the feeder for the lamps


Sidewalk Lift
Vault Lights
Sidewalk Lift
Store
Store
Down
Dist Box
Reception Room
Bed Room
Toilet
Dist Box
Dist Box
Down
Up
Service Entrance
Duplex
Dist Box
Dist Box
Dist Box

space is enclosed in 1-in. slate, while at the top and ends of the board electro-bronze grille work is used. The feeders run to the top of the switchboard, and there are on the board 50 all-copper knife switches for lamps and motors. Rigid iron conduit is used, running into slate-lined distribution boxes, which have a trim that matches the interior finish. The outlet boxes are of iron, enameled inside and out with white porcelain. The wires for all the electrical work are of the best quality copper, 98 per cent conductivity, and the wiring and conduit work throughout are such that either direct current or alternating current may be used. The meters for the tenants' lamps are located on the switchboard, and thus the occupants of the various apartments are spared the visits of the meter readers. The heating receptacles in the laundry, which will be more fully described later on, are also wired so that they can take energy through the respective meters.

The panel boards are 1-in. slate, with three busbars connected through double-pole knife switches and open-link fuses. The busbars run up the center and have fuse-posts on either side, with the main lugs and switch at the end. Each panel has a main switch of 25 per cent greater capacity than the entire panel, and a "goose-neck" and key socket for a possible lamp. This latter is placed on a separate circuit switch with a white handle, placed in the same position on all panels. Each circuit is numbered and the distribution boxes are provided with diagram and scale-plan, showing the lamps controlled and the size of the fuses.

The switches for local control in the various rooms are placed on the knob-side of the door and are of the push type. Where there is more than one switch, engraved gang-plates are provided, the switch which each push controls being marked above it.

The following motors were wired for:

1 sump pump	3 hp	1 freight elevator.....	10 hp
1 sump pump	2 hp	1 ash hoist.....	8 hp
2 house pumps	5 hp each	2 sidewalk lifts.....	8 hp each
1 vacuum cleaner pump..	12 hp	2 thermostat compressors.	2 hp each
1 refrigerator compressor.	15 hp	1 clothes dryer fan.....	½ hp
2 circulating pumps.....	3 hp each	2 outlets in sub-basement.	5 hp each
1 passenger elevator.....	20 hp		

Among the special features already enumerated in the apartment house is the plate-warmer which was installed in each butler's pantry. There plate-warmers are constructed with a cast-iron frame, nickel-plated, and a Russia iron body and door. The triple walls are asbestos filled, with a thermometer on each door. Each warmer is provided with the proper switches for three heats, and is connected to the wiring by means of a heating plug and receptacle. The warmers are 3 ft. 2 in. wide, 16 in. deep and 24 in. high, outside measurements, and have one shelf.

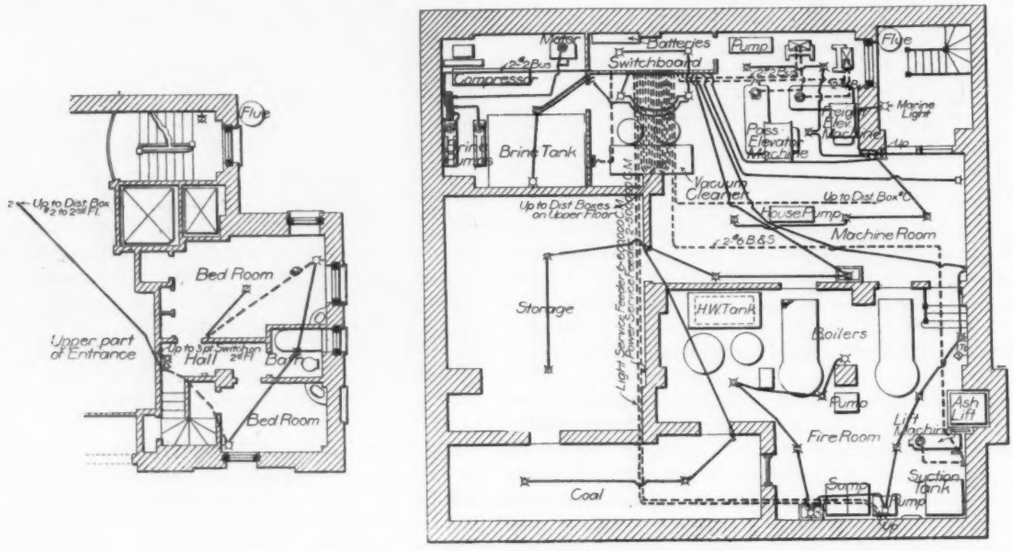


FIG. 2.—METHOD OF FEEDING BASEMENT LAMPS AND MOTORS.

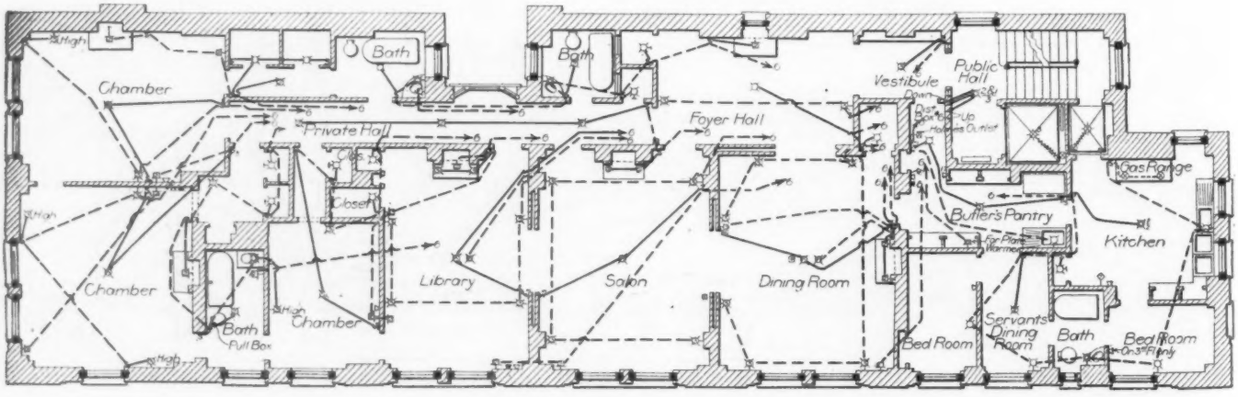


FIG. 3.—PLAN VIEW OF SIXTH FLOOR.

The laundry conveniences are another feature which is more than commonly elaborate. Besides the clothes dryer, equipped with electrical fan, there are also in this basement laundry, special arrangements for the use of electric irons. Above each of the five ironing-boards there are two outlets, each one closed with a strap or hasp which locks on and to which the

respective keys are held by the tenants. Thus the energy is charged the proper meter.

An unusually elaborate low-potential system was also installed, consisting of call bells, three telephone systems and a Holmes protective system. The connection boxes for this work in each apartment are built like distribution boxes, with one compartment for the public telephone, one for the Holmes system and one for all other wires. The public telephone system has outlets in the stores on the first floor, in the public entrance hall, in the superintendent's apartment and in the butler's pantry of each apartment. Each of the two messenger call companies also has a call box in the butler's pantry of each apartment.

There are two systems of private telephones in the house, one for use throughout the building and an intercommunicating one in each apartment. The former of these has outlets in the boiler-room, laundry, tradesmen's entrance, in the twelfth floor hall, in the superintendent's office, and in the butler's pantry of each apartment. The switchboard for this system is of the hotel drop annunciator type rearranged so as to be set in a table and is located in the main hall. Twenty stations are provided for, with all the devices and attachments which make a durable and reliable telephone switchboard.

The intercommunicating system is very complete, the outlets varying slightly on the different floors. The sixth floor plan which is shown is fairly typical, and here the outlets are in the library, the butler's pantry, kitchen, and the servants' bedroom. But on this floor all the servant's quarters, except the additional bedroom with each apartment, which is supplied on the twelfth floor, are in the apartment. On the second and eleventh, the servants' quarters are arranged on mezzanines, connected to the apartments through private stairways. The twelfth-floor arrangement is elaborate; besides the bedrooms, mentioned above, there are four living-rooms and baths connected with the servants' bedrooms.

The call-bell system includes an annunciator in the boiler-room, connected to the ash lift on the sidewalk, the entrance of the machine-room and the main entrance, this latter being also wired to the annunciator in the hall. The sidewalk pushes ring in the respective stores and the push at the service entrance is connected to a bell at the foot of the service elevator shaft. Each apartment has an annunciator in the kitchen which is connected to push buttons at the front door, hall, service elevator shaft, salon and each bath. Each dining-room has a combination floor and extension push connected to a buzzer in the butler's pantry.

As will be seen from the above description, neither the architect, Mr. Alexander M. Welch, nor the engineers, Pattison Brothers, have spared any pains to bring the apartment house up to the level of the highest modern demands. It gives to its occupants all the conveniences of the hotel and yet preserves the privacy of the home.

New Telephone Patents.

WIRELESS TRANSMITTING CIRCUIT.

An arrangement of circuit for associating a telephone transmitter with a radiating conductor forms the subject of a patent granted to Mr. Harry Shoemaker, of Jersey City, N. J., and assigned by him to the International Telegraph Construction Company. An electric arc is supplied with current of a frequency above the limit of the ear.

A shunt circuit is then put around the arc, this shunt containing capacity and inductance and including one winding of an induction coil. A telephone transmitter is then arranged to effect the shunt circuit, either by direct inclusion in it, or by subjecting the arc to a magnetic field controlled by the transmitter. The primary circuit thus formed is adjusted to a natural period above the limit of the ear, yet low compared to an oscillating frequency such as exists in the radiating conductor, and the induction coil winding of the primary circuit is associated with a secondary winding connected to the radiating circuit. By this means there is impressed upon the radiating circuit the current fluctuations set up by the transmitter.

AUTOMATIC SELECTOR.

The automatic selector always consists of two main elements, namely, the contact bank to which is connected the various circuits, and the wipers with their selecting motor or motors.

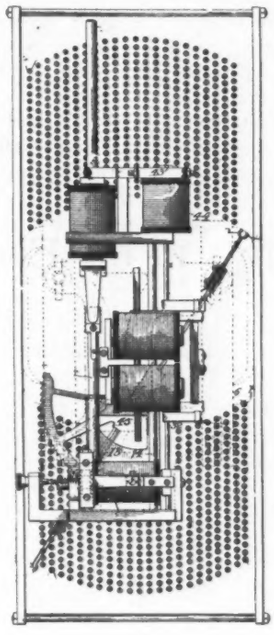


FIG. 1.—LOVERIDGE SELECTOR.

These two are, of course, interdependent, as the wipers must operate to conform to the terminal scheme of the contact bank. Heretofore the terminals have most often been arranged in horizontal rows upon a cylindrical surface, the terminals projecting radially inward. These wipers, therefore, have a vertical motion longitudinal of the axis of the cylinder and a rotary motion about this axis.

Mr. F. K. Loveridge, of Chicago, Ill., has patented a selector with another arrangement of terminals which can be reached by one vertical and one rotary motion. This is shown in Fig. 1. It will be seen that the vertical motion moves the carriage carrying the horizontal rotating shaft. This latter, with its arm, may then swing over the circular contact row. The arm swings free of the contacts and is then drawn home by a connecting magnet. The patent for this selector is assigned to the Western Electric Company.

TELEPHONE CIRCUITS.

Common battery switchboard circuits of the two-wire and three-wire types are frequent, but the one-wire circuit recently patented by Mr. J. L. McQuarrie, of Oak Park, Ill., is quite novel. The circuits are so arranged that the cords are of the

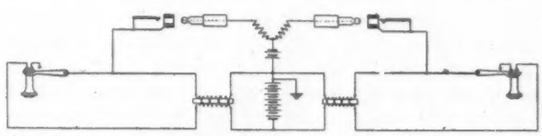


FIG. 2.—M'QUARRIE SWITCHBOARD CIRCUIT.

single-strand type and but one wire per line need be carried through the jacks. The rudimentary circuit is shown in Fig. 2. It will be seen that for currents originated at any station the double-wound coil—in reality that of the line relay—is cumulative in its effects so that the talking current prefers the jack branch. For received currents the double winding is differen-

tial and, therefore, offers little obstruction. The patent for this system is assigned to the Western Electric Company.

Two other patents assigned to this same company refer to a combined intercommunicating and exchange system, or what might be called an intercommunicating private branch exchange. Both refer to key arrangements to secure the proper operation of the trunks. Mr. J. L. McQuarrie's patent provides contacts such that after an exchange call has been answered and the answering station has called the desired station, a relay will operate to hold the trunk against disconnection at the exchange until the called station may respond. With the response of this station the relay is released to pass the control to this called station.

The second patent, granted to Mr. N. H. Holland, of Chicago, Ill., provides similar protection against disconnection of the trunk during the period when the desired station is being rung from the answering station.

Letters to the Editors.

Movement of Magnetic Particles in a Rotating Field.

To the Editors of Electrical World:

Sirs:—The lines of a magnetic flux rotating pivotally around the stator of a polyphase induction motor from which the rotor has been removed—as indicated in the experiments which Professor Boleman describes in your issue of July 22—are not confined in direction to planes perpendicular to the stator axis except at the mid-section of the ring. About the upper and lower rim of the short cylinder which forms the stator, the rotating field passes from side to side diametrically, not in a plane, but strongly convex outward.

Discrete particles of magnetic material disposed in a plane tangent to the stator rim will, if they are small, be subjected to a couple tending to rotate them about their mass centers and in the same sense as the field rotation when the field passes over them. The action is directive like that of the earth on a magnetic needle.

It is immaterial whether the particles are above or below the stator; so long as they are within an area bounded by a section or projection of the ring, their rotation is always with the field. They may, therefore, be used to determine the direction of motion of the latter.

In addition to this rotation of the particles themselves there is a drift, or vortex, about the central axis of the stator. The vortex motion is due to friction and is with the field or counter to it, accordingly as the material plane upon which the particles move is below or above the stator mid-section. In this section there is no drift. Though not the same thing, the phenomenon bears some analogy to the precessional motion of a gyrostat.

Consider a clockwise field, with the particles in the upper plane. Iron filings being, as a rule, elongated bodies and readily assuming the direction of the lines of force; near the stator rim they are tilted obliquely, the outermost end—reckoning from the axis of the ring—being held in close contact with the supporting plane by the magnetic force. In this position they are caught by the clockwise couple, but owing to the interference of friction at the point of contact the mass center swings toward the approaching field. The particle executes a partial clockwise rotation, but, as a whole, advances by approximately a length against the field owing to the resultant pull of the latter. No other motion is possible consistent with clockwise rotation and frictional reaction applied at the outermost end of the particle.

Similar conditions obtain below the stator. Here, however, the oblique tilt results in the application of friction to the innermost end of the particle. The reaction has changed ends, and, therefore, interferes with the other element of the couple. The particle again rotates clockwise, but pivots on the inner end, and hence the action on the mass center is resolved into a push driving the particle ahead with the field.

Above and below the particles drift in opposed spirals, ultimately piling up at the center. This phenomenon is again largely mechanical. Both rotation and drift depend upon the shape and size of the particles and upon the character of the surface upon which they move. The experiment readily lends itself to projection for observation. A low field rate, say, a few cycles per second, permits observation of drift and rotation better than the usual frequencies.

The rotation of disks of magnetic material with free, or more or less constrained axes—the latter passing through the mass center—form an interesting study. A free iron "button" tends to spin on a diametral axis. This axis is approximately coincident with the direction of the lines of force. With such a figure, however, gyrostatic action combines with the play of magnetic and frictional forces, and tends to right the disk relatively to the stator plane. There will be, on the whole, the same sort of tilt as with the filings and the phenomena are similar to those described by Professor Boleman.

A constrained iron disk, for example, one pivoted on a fixed axis, will, if its plane is parallel to the tangent plane of the stator, and is within the limits of its bore, run with the field as regards direction of rotation. If this were not the case, above and below, it is not apparent how the regular rotor could run at all. The rotation will not be reversed if the outer end of the disk's axis—that is, the upper, when the disk is above, and the lower end when it is below—is gradually drawn away radially from the stator center until the axis is turned into a horizontal position. Evidently two disks, if thus manipulated, will show opposite rotation when the axes become parallel and are viewed from the same side. Were this translation of the axes continued the disks would come to a stop, as the magnetization would become purely transverse, thus resulting in no torque. With a further advance, rotation would begin once more; really in the previous direction, but apparently reversed because of the inversion of the physical axis. Since the induction is, in general, not parallel to the magnetizing force, the speed of rotation and the azimuth in which apparent reversal occurs, depends on a number of factors involving physical qualities and conditions.

In the communication of Professor Boleman it is not stated, in connection with the experiment of the partially constrained disk, what relation the latter bore toward the thread shown in the illustration as extending from the disk's center toward some fixed point located well up the stator axis. If the thread was in the plane of the disk, the latter would be simply an element of a larger mass with an axis coincident with that of the stator. An upward component of centrifugal force here counteracts frictional resistance. The disk skids along the plane and follows the field. Should the thread be perpendicular to the plane of the disk, the latter would stand with its upper edge tilted outward. The constraint being less than in the previous case, and one freedom being gained, the disk would now be free to roll. Since the magnetic induction would mainly follow the contact diameter, there would be a resultant push on the mass center—as upon filings placed below the stator—even though the tilt of the magnetizing field itself were directed toward the stator.

The entire phenomena constitute a neat illustration of the composition and resolution of rotations, as well as of the properties of magnetic fields.

St. Louis University,
St. Louis, Mo. H. J. De Laak.

The Atlantic Cable of 1858.

To the Editors of Electrical World:

Sirs:—Before replying to the second, and more lengthy, article of Mr. William Maver, Jr., I desire to say that having now re-read his first article I recognize that it has many merits, notwithstanding the disadvantages under which it was put together. Moreover, on again reading my letter commenting thereon, I regret that I expressed myself in the precise terms I did. It seemed to me, however, at the time that Mr. Maver was taking up a somewhat critical, and scarcely justified, posi-

tion regarding a great pioneering work; for I must admit that I was not familiar with his name in connection with submarine telegraphy. I find, however, that Mr. Maver is a leading authority on land telegraphy, and is the author of several authoritative works and papers dealing with this subject. I was partly misled by the letters "Jr." after his name, which in our country would suggest youthfulness rather than anything else! My original view of Mr. Maver's first article was accentuated, as I explained, by the misspelling of names. I had thought that this feature was common to the article in your journal and also to its appearance in *Telegraph Age*, but I now find that the name "Elliott" is the only name misspelled in both. This should be spelled with one *t* only, for Sir George Elliot, of Glass, Elliot & Company, should not be confounded with Eliott Brothers, though working somewhat in the same sphere.

In my comments on Mr. Maver's first article I should have added that the ultimate failure of the first Atlantic cable might, of course, be largely due—as suggested by Mr. Maver—to "the inexperience in cable making at that time," though the high-tension electricity, with induction coils, employed during the working of the cable was, in my opinion, more directly the cause. Before leaving this previous letter of mine, and in view of a suggestion made by Mr. Maver, I would repeat what I previously implied—i.e., that this first letter was written as soon as I happened to see Mr. Maver's first article.

Turning to his second article, I observe that Mr. Maver has taken occasion to examine some of my books as well as much else connected with the subject; but I regret that it will not be possible for me to deal with all he has to say in detail in the course of his second article. I must, indeed, confine myself to the general trend of his views—more especially concerning the points I touched on in my previous letter.

First of all, with reference to some of Mr. Maver's early suggestions—for which I bear him no ill will under the circumstances—I would mention that my father was knighted on Sept. 4, 1858 (a fact which can be verified at the Lord Chamberlain's office in London), exactly a month after he had completed his work of laying the first Atlantic Cable. I would point out, too—in view of the line now openly taken by Mr. Maver—that my father would scarcely have been offered a baronetcy in connection with subsequent work if the suggestions now made by Mr. Maver were borne out by facts. (The further honor referred to was refused for pecuniary reasons.)

Mr. Maver speaks of the repeated "coiling and uncoiling" and also of the "cutting and hacking to which the cable was subjected before its submersion in the effort to localize and remove defects." It should, however, be remembered that neither coiling, uncoiling nor cutting a cable is seriously debarred in submarine cable work. I agree with Mr. Maver to a great extent in regard to his remarks on the heating of the cable by exposure to the sun. He is perhaps, however, unaware of the conditions of the contracts and the circumstances under which the work was carried out. Insufficient capital and time (for which none of the technical officials was responsible) explains the non-adoption of a number of my father's recommendations, including not only a much larger cable (ultimately adopted on the second and third Atlantic lines), but provision for the line being kept constantly under water. Still, it has to be remembered that if a cable contains incipient faults such as do not reveal themselves ashore, its defective condition is soon made evident on submergence at the depths of the ocean. In the case in point, however, the failure of the line was a gradual one. The cable appeared, indeed, to be fairly healthy—comparatively speaking—up to the time when it was handed over for working from each end.

I regret to find that Mr. Maver considers that I have been unfair to Dr. Whitehouse, a very able physician who took up the subject of ocean telegraphy warmly, though only temporarily. This was very far from my wish, for he was a man of many charms, notwithstanding ill health. It has, however, to be borne in mind that the apparatus he applied to the cable when handed over to him for working through from shore was entirely opposed to the strongly expressed views of Professor Thomson, as well as of my father, both at the time and previously in the course of a correspondence which followed on some letters published in *The Athenæum*. (These letters revealed the fact that Dr. Whitehouse favored a small conductor for a long length of cable.)

Mr. Maver considers that I have misquoted the sense of Professor Thomson's and Mr. Varley's views on this point; but with all deference to him (Mr. Maver), I cannot see that my abridgment of their views constitutes a material difference in their actual nature. Moreover, Professor Thomson had previously expressed himself sufficiently definitely in the correspondence already referred to, as well as later—if not actually when giving evidence. Further, if there was then any doubt on the suitability of high-tension currents and induction coils for working cables, there is certainly not now.

I do not think Mr. Maver quite followed my point in his reference to what I say in my books about the breaking down of the 1865 and 1866 cables shortly after they had been laid. Faults soon appeared in these lines, but the faults—at specific points—were of a nature that could be repaired; whereas there was every appearance of a gradual and more or less uniform breaking down of the first Atlantic cable throughout its length, as it received its increasing doses of high-tension electricity. Mr. Maver seems to favor the idea that the break-down was mainly due to the application of tar outside the cable; but, without denying that this might well have been a contributory cause, it may be pointed out that, with the exception of the 1865 Atlantic line, every cable laid has since been covered with a tarry compound as a preservative against decay. On the other hand, the Whitehouse transmitting and receiving apparatus has never been employed for working any cable since that of 1858.

Mr. Maver comments on the fact that, in my books, I have not quoted Mr. W. T. Henley's views as to the cause of the failure. I would, however, mention that—like Mr. Maver, apparently—I have sifted the evidence to the best of my ability and have quoted that which most appeals to me as a result of the sifting. Whether Mr. Maver's views or my own are correct I am not prepared to say, though I think I may claim that my views are, at any rate, equally well backed up by other authorities and by subsequent experience. I am, of course, fully aware of the importance of a cable being tested under water during manufacture, and can scarcely be accused of ignoring Mr. Henley's opinion for filial reasons, seeing that this was one of the first precautions pressed for by my father. It should perhaps be added that Messrs. Glass, Elliot & Company, on the one hand, and Messrs. R. S. Newall & Company, on the other, were responsible for the manufacture of most of the pioneer submarine cables—with greater experience than their rival, Mr. Henley—and that the former firm (subsequently the Telegraph Construction & Maintenance Company) has manufactured more of the succeeding cables, now at the sea bottom, than any other firm. Though I do not think it is a point of much importance, I would mention—as Mr. Maver raises the question in this connection—that Mr. C. V. Walker (an honored name in telegraphy) was not a director of the Atlantic Telegraph Company.

Mr. Maver, quite naturally, draws attention to the fact that in "Submarine Telegraphs" I mainly attributed the failure to faulty metallic joints rather than to the apparatus employed for signaling through the line when laid; but when I wrote the book in question I had not an opportunity of examining all the official papers now in my possession. Mr. Maver also quotes from the report of the committee appointed to inquire into the construction of submarine telegraph cables, and remarks that it is strange that I have not done so in any of my books. I have, however, made several references to this inquiry, without actually quoting the particular passage in the report to which he draws special attention. In case anyone attaches special significance—such as appears to be suggested—to my not setting forth in my works this particular clause of the report, I would ask him to consider, or inquire, who had most to do with the laying of subsequent marine cables, whether for Government

or otherwise. In this connection it may be worth quoting a distinguished telegraph engineer and electrician, Sir Henry Mance, C. I. E., past-president of the Institution of Electrical Engineers, in the course of an address regarding submarine telegraphy in 1897. Sir H. Mance remarked: "If we, as engineers, desire to do honor to any one individual who pre-eminently distinguished himself in the development of oceanic telegraphy we have simply to refer to the list of our past-presidents and select the name of Charles Tilston Bright."

I cannot quite follow Mr. Maver's meaning where he says: "By the way, my critic's chief witness, Mr. Varley, joined in signing this verdict." I am entirely with Mr. Maver in his high regard for Varley as an electrician—indeed, next to Lord Kelvin, no man did more for the satisfactory electrical working of cables than Varley, on the one hand, and Willoughby Smith, on the other. But Varley, like Galton, Wheatstone, Fairbairn and Bidder, was not associated with ocean cable laying or with the manufacture of cables. The electrical members of this committee, especially Varley and Latimer Clark, would, however, be excellent authorities on the effect of the Whitehouse apparatus on a cable; and they were certainly unfavorable to high-tension electricity for working the Atlantic cable.

As regards the joint experiment of Varley and my uncle to which Mr. Maver alludes, this seems to me to point rather in favor of my view than otherwise. In a word, I still beg leave to differ with Mr. Maver respecting the cause of failure, and while recognizing the importance of much that Mr. Maver sets forth, I venture to think that a study of the entire evidence, including that of Professor Hughes and Professor Wheatstone, could be turned in favor of my views as much as his. The complete abandonment of the Whitehouse apparatus (together with personal reasons) was, perhaps, sufficient reason for the committee omitting to set forth the unfavorable effects of such apparatus on an insulated wire of this character. However, I quite recognize that faults of manufacture—due to lack of experience—are very likely to have existed in the cable before it was actually worked through, though, in my opinion, no cable of similar dimensions would have stood the operation for long with the said apparatus in use. Moreover, from the particulars I have available, it certainly appears probable that the cable would have worked satisfactorily for a considerable time but for these high-tension currents.

Mr. Maver is critical about the paying-out gear on the *Agamemnon* and *Niagara*. With all due deference to his opinion, I cannot see that it is substantially supported by Sir Samuel Canning (my father's chief assistant), while Captain Moriarty, the distinguished navigator whom Mr. Maver also quotes, had nothing to do with the working of the apparatus or the laying of the cable.

Mr. Maver takes me to task for stating that Brett and my father had preceded Cyrus Field in projecting the Atlantic cable. Let me assure Mr. Maver, however, that whatever I said on the subject was not at all from the point of view that he attributes to me, but was intended rather to show that others besides Mr. Cyrus Field had been working at the idea when the latter gentleman, a famous American merchant peculiarly gifted with intense energy and industry, came over to this country and sought Brett and my father. Still, here again, I must admit I had not done justice to Mr. Maver's original article which was, I see now, quite temperately expressed in this matter, as compared with what I have often seen. On the other hand, I am afraid I cannot quite fall in with the view adopted in Mr. Maver's further article in this regard, i.e., where Mr. George Saward's evidence is quoted in reference to the origin of the Atlantic Telegraph Company, if only for the reason that the formation of the company followed long after a good deal of investigation and other preliminaries in this country, as well as in North America, where Gisborne was especially forward in the matter. Mr. Saward was not in a position to speak with authority regarding the work that I refer to in his own country, for his connection with the subject commenced when he became secretary of the Atlantic Telegraph Company, with Mr. Cyrus Field (the general manager) as his immediate chief. But Mr. Field's energy was turned to account in a way that will never be forgotten in England, any more than in America, and though the capital (so far as it went) was mainly raised in England, this was not for lack of strenuous effort and noble support on the part of Field.

Mr. Maver avails himself of the opportunity in his second article to recount the important services of Mr. W. E. Everett, U. S. N., in regard to the first Atlantic cable, and I am sorry to find that he also takes occasion to express the view that I have not done that distinguished officer proper justice in my books. Mr. Maver has evidently arrived at the conclusion that Mr. Everett was in "sole and responsible charge on the *Niagara* of the successful laying of one-half of the cable in 1858," and he gives his reasons. These are quite in keeping with the records of Mr. Mullaly (a well-known American journalist and author), a glance at whose writings would lead a reader to suppose that Mr. Everett was the engineer-in-chief and my father only an assistant. Mr. Maver also, quite properly, quotes from official correspondence, which tends to give color to the idea. It is made clear, however, from further correspondence, as well as from the reports of the expedition to the board, that Everett acted in the capacity he did on the *Niagara* under instructions from my father, the engineer-in-chief of the whole undertaking (who obviously could not be on both ships at once), as did Mr. Woodhouse also, and in precisely the same way that Mr., afterward Sir Samuel, Canning and Mr. Henry Clifford did on the *Agamemnon*. That clever engineer, Mr. F. C. Webb (one of my father's staff on the 1857 expedition), was not available subsequently, and it was in this way that, at the instigation of Mr. Cyrus Field, Mr. Everett joined the engineering staff.

Mr. Maver also considers that I have not done Mr. Everett proper justice in my books in regard to his association with the paying-out apparatus. I can only say that I dealt with the subject to the best of my ability—based on a great many official documents, and have certainly had no such intention as appears to be suggested. Through his countryman, Mr. Field, Mr. Everett (who had been the chief marine engineer of the *Niagara* on the 1857 expedition) became a member of the advisory committee relative to the proposed paying-out gear for the 1858 expedition. Of the other three members, one was the chief of the steam department in Her Majesty's Navy, and the other two leading engine makers. The design of this apparatus (fitted to both vessels) was worked out by my father (as the responsible engineer-in-chief) in conjunction with Mr. C. E. Amos, of Messrs. Easton & Amos, who constructed the gear. It was arranged that Mr. Everett should supervise the construction and fitting of the gear, in view of the fact that it would be under his charge on the *Niagara;* and it was on this latter account, as well as owing to his knowledge of machinery connected with ships, that he was attached to the said committee for reporting on the new designs. If, however, any of your readers prefer to consider that this distinguished naval officer (Mr. Everett) was as much in charge of the laying of the first Atlantic cable as my father, or that he (Everett) was solely responsible for the design of the paying-out apparatus, he is welcome to do so; just as they are also welcome to a preference for the version of Mr. H. M. Field and Mr. Mullaly to my own. The perfectly natural rivalry of nations would in itself be sufficient explanation, no doubt. I can assure you, however, that any words of mine on the subject in my various works have been the result of a dispassionate and laborious sifting of evidence from official documents—published and unpublished.

Though I cannot agree with several of Mr. Maver's conclusions, I desire to repeat that on a second reading I realized his original article was a fair summary, and that I should have expressed my previous letter—regarding certain portions of Mr. Maver's remarks—in more moderate terms. Further, I quite recognize now (notwithstanding some of his unfavorable criticisms) that he has closely studied the subject as far as was possible for him to do. I see that in using the term "exclusive"—in reference to the basis of my writings—he puts that word in inverted commas. I would, however, say that this

phrase has never been employed by myself in that connection, though certainly my contributions to the literature on the subject are based on official documents, many of which have never been published.

I am much obliged to Mr. Maver for pointing out an apparent discrepancy in my "Submarine Telegraphs." I am far away from that somewhat ponderous volume at present, and can only account for the discrepancy by the fact that different batteries were employed at different times during the 1857-8 expeditions, the particulars of which I had, as it happens, from Lord Kelvin himself, the previous Professor Thomson that Mr. Maver quotes.

Finally, I am sorry to find that Mr. Maver and myself are at "loggerheads" in the distinction between an "engineer" and an "electrician." I cannot help thinking, notwithstanding what Mr. Maver says, that this must be due to a difference in American and English usage of the words. In submarine telegraphy, at any rate, we do not speak of "electrical engineers." Aboard a telegraph ship there is the engineering staff and the electrical staff, those on the latter being termed "electricians"; and I venture to submit it was always so. I note, by the way, that further on Mr. Maver, seemingly, apologizes for confusion between engineers and electricians—i.e., between those who "merely laid" cables and others. While, of course, endorsing Mr. Maver's views of Lord Kelvin and Cromwell Varley, I do not think that Lord Kelvin himself was inappreciative of those who "merely laid" cables—such as my father—judging from his Lordship's remarks regarding the latter at executive meetings of the International Memorial to the Inception and Extension of Submarine Telegraphy, as well as on other occasions when speaking of the Atlantic cable and subsequent enterprises with which my father was responsibly associated. Sir Henry Mance's views in the same regard I have already quoted.

Permit me to conclude this communication by cordially re-echoing the wish of her late Majesty, Queen Victoria, in regard to the Atlantic cable being "a bond of perpetual peace and friendship between the kindred nations," hoping that any difference of opinions between Mr. Maver and myself may be happily smoothed over, if only on the principle that "it will be all the same a hundred years hence!"

LONDON, ENGLAND. CHARLES BRIGHT.

P. S.—The above has been written while on holiday in the wilds of Surrey. Thus, like Mr. Maver's original article, it is put together under some disadvantage. On the other hand, but for the conditions I fear it would have been impossible for me to make any adequate reply to Mr. Maver's more lengthy article. This I was anxious to do, if only out of courtesy, and in justice to Mr. Maver. Realizing that the last word would, by right, rest with me, I have made a point of expressing myself this time in moderate terms and in a way, I think, that no answer would be called for. But if Mr. Maver is intent on the last word, he certainly will have the advantage of me, for in a week or so I expect to be fully engaged on more important matters than a discussion concerning the pioneer days of submarine telegraphy, and this expedition will probably take me out of touch with post or papers for some time to come. C. B.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Silicon Steel.—E. KOLBEN.—An account of an investigation of the influence of silicon on the electric and magnetic properties of iron. Some of the results are given in the following table, from tests of sheet steel of 0.5 mm thickness. Five different silicon steels were tested.

		A	B	C	D	F
Per cent silicon.....	min...	0.026	1.07	2.28	——	3.50
	max...	0.30	1.54	3.15	3.25	3.53
"Watt loss coefficient"	min...	3.5	2.6	2.3	2.3	——
	max...	3.8	3.0	2.6	2.0	1.85
Specific resistances in ohms per cc.		0.118	0.287	0.355	0.500	0.595
Increase of resistivity per 100 deg. in per cent.....		41.0	19.0	14.0	7.5	5.0
Tensile strength for minimum per cent of silicon.....		30.8	35.1	47.3	——	61.0
Hysteresis coefficient for minimum per cent silicon.....		0.0015	0.0014	0.0010	0.0009	0.0009
Hysteresis watts per kilogram silicon		2.5	2.2	1.65	1.45	1.45
Eddy-current watts per kilogram silicon		1.3	0.8	0.7	0.6	0.4
Total watts per kilogram silicon.		3.8	3.0	2.35	2.05	1.85
Magnetic induction B for magnetizing force H = 140.....		17,600	17,300	17,000	16,700	16,400

A silicon content of 3.5 per cent is specially suited for starting and regulating resistors. The mechanical strength of the steel is increased by a certain content of silicon, while simultaneously the elongation decreases, but the material is somewhat unreliable and subject to great differences; this is probably due to the method of manufacture. The silicon steels are specially suitable for transformer construction, but since high-silicon steels are very brittle, the steel F cannot be used for rotating armatures of turbo-generators. However, the B and C brands can be usefully employed for dynamo construction. Permeability is very slightly influenced by the high content of silicon. The aging of steel at higher frequencies and at a temperature of 100 deg. C. disappears completely in high-silicon steels. With a 3.5 per cent content of silicon the aging coefficient is zero.—*Elek. Kraftb. u. Bahnen,* July 3.

Motor with Mixed Windings.—A note on a motor built by a Danish company. It is arranged for starting at full load without resistances and its direction of rotation can be reversed without difficulty. This result is obtained by fitting every second pole core of the magnet frame with a series winding, the other poles on the frame being provided with a winding which is in parallel with the armature. These two exciting windings are so arranged that the m.m.f. of the series windings opposes that of the shunt windings. The relation of the two windings can be so adjusted that the speed of the motor will vary in a definite manner according to the load. For instance, the motor can be designed to run at the same speed at any load or to run at higher speed when the load is reduced. A motor of this kind is said to be specially suitable for working cranes, hoists and, in fact, all machinery which is frequently started, stopped and reversed.—Lond. *Electrician,* Sept. 10.

Rotary Field of Induction Motors.—R. E. HELLMUND.—In a paper read before the St. Louis Congress, Prof. C. A. Adams called attention to certain differential fields in the rotary field of an induction motor. Their effect is somewhat similar to that of stray fluxes. In the present article the author gives graphical methods and shows how the effect of the differential fields on the operation of induction motors can be taken care of theoretically by an increase of the stray-flux coefficient. He also gives a brief note on a simple practical method for calculating the coefficients.—*Elek. Zeit.,* Sept. 9.

Lamps and Lighting.

Tungsten Lamp.—An article stating that the firm Wolfram (tungsten) Metal Filament Lamps, Ltd., has been given permission by the British Patent Office to amend the specification of the fundamental British patent for the manufacture of pure tungsten filaments, in three important respects. All references to the metal molybdenum have been taken out; a description of a chemical process for substituting tungsten for carbon has been eliminated; and a disclaiming clause taking note of three prior patents relating to metal filaments has been added. The patent now covers a process for manufacturing pure tungsten filaments by mixing a powdered tungsten compound with an organic binding agent, squirting this mass into filaments, carbonizing and then removing the carbon by raising them to a high temperature in an atmosphere of steam and hydrogen.—Lond. *Elec. Eng'ing,* Sept. 9.

Automobile Head Lamps.—A note on the use of gold mirrors

for search lanterns with reference to recent tests of motor-car head lamps. It has always been taken for granted that the whiter and more powerful the light, the more perfect the illumination obtained. This, however, is not the case, for the rays of low refrangibility—that is, the red and yellow rays—are far less absorbed by the atmosphere than are the violet rays. Again, the red color exhibited by the sun at its setting is due to the fact that the violet rays are largely absorbed by the greater thickness of atmosphere, which must be penetrated by the sun's rays. To achieve the desired results a long series of experiments have been made with glass mirrors coated with gold instead of the usual silver deposit. The resulting beam of light is practically devoid of the blue and violet rays of the spectrum, being composed of red, yellow and green rays only. At the same time its range or penetrative power is not reduced by the elimination of the violet rays, while the dazzling effect is greatly decreased. —Lond. *Electrician,* Sept. 10.

Generation, Transmission and Distribution.

Electricity in Coal Mines.—J. Paul.—An illustrated paper read before the Mining Institute of Scotland on electric energy generation and distribution at the collieries of the Lochgelly Iron & Coal Company, Fife. There are two triple-expansion engines directly coupled to two three-phase alternators with a frequency of 50, having exciters on the same shaft. Each of the combined sets is designed for a continuous output of 420 kw at 0.8 power factor (and for 25 per cent overload for periods of two hours at clear intervals of six hours) at from 3000 volts to 3300 volts when running at 375 r.p.m., either exhausting into a condenser with a vacuum of 26 in. or into the atmosphere. Some notes are given on the construction of the transmission line, and especially the design of the wooden poles. In transformer stations the voltage is reduced to 525. For haulage, pump and fan drives use is made of induction motors, including both the slip-ring and squirrel-cage types. As to the outlay, it is stated that the generating costs, based on the load diagram, plus the capital charges, namely, interest on capital and sinking fund to redeem the capital in 20 years, will enable the company described to deliver electrical energy at any point in the coal field for something less than 0.6 cent per kw-hour; with an increased load the cost per unit will be even cheaper, owing to the fact that much of the capital expenditure already incurred really belongs to the possible and probable extensions. —Lond. *Electrician,* Sept. 10.

Power in Mines.—L. Pasching.—The first part of an illustrated description of the Castelnuovo-Valderno power plant of the Societa Mineraria ed Elettrica del Valdarno, in Italy. This company has extensive brown coal mines, but the brown coal contains from 40 per cent to 50 per cent water. Instead of mining and transporting the coal elsewhere, it was decided to use the coal at the spot in a power plant, since there is a sufficient market for electrical energy in the neighborhood. Three-phase currents are generated at 33,000 volts and transmitted by five high-tension lines to Florence, Prato, Fignile, Sienna and Valdarno. There are three 1800-kw generators, producing three-phase currents at 6000 volts and 50 cycles. For transmission the voltage is raised to 33,000. The paper is to be concluded.—*Elek. Zeit.,* Sept. 9.

Steam Turbines.—A. Ceytre.—The first part of an illustrated article on the principal features of different commercial steam turbines. The author begins with a discussion of the Parsons turbine.—*L'Industrie Elec.,* Sept. 10.

Traction.

Control of Traction Motors.—A note on a recent British patent (16,997, 1908; Sept. 2, 1909) of the British Thomson-Houston Company and F. W. Carter. Compound-wound traction motors, adapted to be run as generators while the vehicle is coasting or reducing its speed so as to return energy to the line, are so controlled that when an overload occurs the motor will be provided with a full series field m.m.f. so as to bring down the speed, but that the shunt-field m.m.f. will be opposed by a full series-field m.m.f. when the motor begins to generate. This result is accomplished by arranging reverse-current and overload relays in the exciting circuit of a contactor, which, when closed, completes a shunting circuit about the series-field coils of the motor. During normal operation the contactor is closed and the series-field coils are shunted. Should an overload occur, or the motor begin to generate, the contactor is operated and the shunting circuit broken.—Lond. *Elec. Eng'ing,* Sept. 9.

Brakes.—R. Braun.—An article on the importance of electromagnetic track brakes and the correct method of using them. The author emphasizes that the combination of a short-circuit brake with an electromagnetic track brake (the latter being excited from an independent source of current), is superior to any other known combination, with respect to quickness, force, reliability, even on wet rails without sanding. The braking effort of the track brake is not restricted like that of the wheel brake. For electric railways which are already provided with short-circuit brakes, the best method is to combine them with a track brake excited either by a series or a shunt winding. It is of fundamental importance for the track brake always to remain independent of the wheel brake.—*Elek. Kraftb. u. Bahnen,* Aug. 4.

Energy Consumption of Railways.—P. Heinze.—A mathematical article in which the author gives a method of calculating the energy consumption of an electric train, and especially the method of determining approximately the speed at the beginning of the braking period. A graphical method is used to show the work during acceleration and the amount of the heat produced. A numerical example is added.—*Elek. Kraftb. u. Bahnen,* Aug. 4.

Electric Propulsion of Ships.—A note on a recent paper by W. P. Durtnall. The author took as an example the *Lusitania* and showed that by adopting the electrical drive a saving in steam of no less than 31 per cent could be obtained, his figures being based on the test figures published in connection with the trials of that vessel, namely 12.77 lb. per shaft hp-hour and a steam consumption of 11 lb. per kw-hour for the five 10,480-kw turbo-alternators which he would propose to install, while two 8188-hp induction motors, having an efficiency of 93 per cent, would be used on each propeller shaft. In addition to the above saving in fuel, he estimated an equivalent reduction in boilers, stokers, pumps, fans, bunkers, etc. Further, the author stated that quotations he had obtained from manufacturing firms showed that the total weight of the machinery, was, if anything, slightly in favor of the electrically driven ship. He also referred to the use of internal-combustion engines for marine purposes, and mentioned that in the near future, he hoped to be able to publish some tests on a 500-hp vessel to be equipped with the "Paragon" system of electric propulsion in combination with a suction-gas plant.—Lond. *Electrician,* Sept. 10.

Copper Wire.—E. W. Lake.—A critical discussion of the new specifications for trolley wire submitted by Committee W. of the American Society for Testing Materials.—*Elek. Rail. Jour.,* Sept. 18.

Installations, Systems and Appliances.

Belgium.—Statistical data on electricity works in Belgium. There are 108 plants with equipment ratings down to 10 kw. Forty-one plants have a rating of over 100 kw. The three largest plants are two in Brussels, one of 20,000 kw and the other of 10,000 kw, and one in Antwerp of 10,000 kw. There are 48 plants manufacturing electrical machinery or apparatus in Belgium, chiefly dynamos and telephone and telegraph apparatus. —*Belg. Electrotechniker Kalender,* 1909; *Elek. Kraftb. u. Bahnen,* Aug. 4.

Combined Lighting and Traction Plants.—B. Thierbach.—An article discussing the great advantages of adding a traction load to an existing lighting and industrial load, with special reference to the city of Cologne, in Germany. Electric traction was introduced there in 1902, and a comparison is given of the financial results of four years before and after the traction load was added. The lighting station generates single-phase current at 2000 volts, which is converted for traction purposes

in an underground substation in the center of the city into 600-volt direct current. The following table gives the financial results in marks (1 mark = 24 cents).

	Before opening	After of tramways.	Increase in per cent.
Gross income in four years.....	1,881,800	3,907,500	
Average per year.....	470,500	976,900	108
Net gain (after subtracting interest and amortization) in four years.	1,391,000	2,958,300	112
Average per year.....	347,800	739,600	

It is to be considered, however, that the traction plant had to pay more than the real cost for the energy. The excess cost was in four years 407,000 marks, or 100,000 marks per year. If this sum is subtracted from the figures given above, there still remains an increase of gross income of 87 per cent and an increase of net gain of 84 per cent. The chief factor which contributed to this good result was that as soon as the tramways were started, the tariff for lighting and for industrial service was reduced by the introduction of a fair double tariff. This was possible because the considerable amount of energy sold for traction resulted in a great reduction of capital cost and of cost of generation per kw-hour. The author gives detail figures and also a general formula which may be used by lighting plants desiring to add a traction load.—*Elek. Kraftb. u. Bahnen,* July 3.

Alternators in Parallel.—J. W. ANSON.—Some practical notes on the operation of alternators in parallel. After a discussion of synchronizing methods, the author shows how to insure steady running in parallel. There is a great tendency to run plants 2 r.p.m. or 3 r.p.m. over the designed speed, and this is one of the greatest causes of unsteady running in parallel, especially with engines having Corliss or drop-valve gears, which run most steadily and quietly at the correct speed. The reason for the tendency to run fast is due to the inductive nature of the loads now often dealt with. In order to obtain the full output of power from a machine, at the correct voltage of supply, running on an inductive load it becomes necessary to do one of two things: either increase the field current to an excessive amount or increase the speed of the engine. The former method is the better. The author then discusses generators running on loads with a false power factor. He considers the case of an engine-driven alternator carrying the night load on a system where it is necessary for a number of large induction motors to run lightly loaded. When the power-factor meters on the various feeder panels range between 0.3 and 0.5, with perhaps one or two meters reading unity for substations with synchronous machinery, it would be expected that if a reading was taken on the generator power-factor meter, the result would be a power factor of about 0.6 or 0.65, after making allowance for the synchronous plant; instead of that, it is quite probable that the generator power-factor meter will be reading 0.9 or 0.92, and the operator at the switchboard congratulates himself on the good power factor of the generator. If, however, one examines the engine tachometer it is at once seen that the plant is running under false conditions, probably 5 per cent too fast, and with a very light field current; hence the good power factor showing on the generator instrument. These conditions just stated are the worst for withstanding a sudden short-circuit or earth on the system. The correct way to run a plant of this type on a light but inductive load is to slow the engine down until it is running at the designed speed, at the same time increasing the field strength until the machine is maintaining the correct voltage at the correct speed. The generator power-factor meter will then be registering the correct power factor of the system. It is especially difficult to operate two large machines in parallel on light load with any degree of steadiness. The question of speed is of great importance. In this case the r.p.m. should be kept well down, even a shade under correct speed, say, 1 per cent, rather than over, and when the load is falling off the wattmeters should be watched carefully, so that every time the load eases down definitely the engine speed can be kept constant, either by switchboard governor control or by hand. The field current is also of great importance. With the speed kept low, as advocated above, just sufficient field strength should be kept on the machine to maintain the exact line voltage.—Lond. *Electrician,* Sept. 10.

Electric Water Heater.—An illustrated description of, and an editorial on, the "Therol" electric water heater, the special feature of which is the use of heat storage. One of the difficulties of electric heaters hitherto has been the fact that if water is to be heated rapidly a comparatively large current is necessary. In the "Therol" heater this difficulty is overcome by storing the heat in a block of iron which is cast round a spiral tube and carefully lagged. Thus, if only a small amount of power, say, 200 watts, is used continuously for heating the iron, the heat produced is stored until hot water is required. When that is the case, the cold water is drawn through the spiral, and as this, through prolonged heating, may be at a much higher temperature than that of boiling water, hot water is at once obtained and may be drawn continuously until the temperature of the iron block is so far reduced that it cannot supply heat quickly enough to maintain the temperature of the water at what the householder may regard as "hot." The heater is shown in Fig. 1. In its simplest form the apparatus consists of a block of

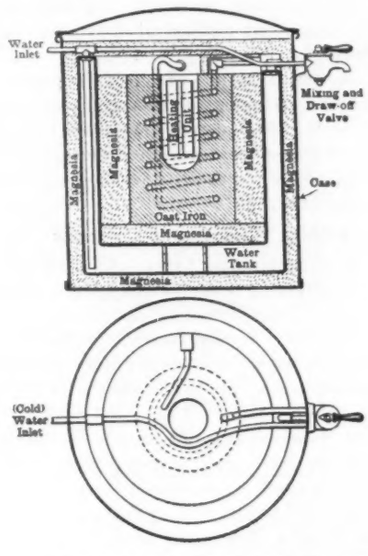


FIG. 1.—PLAN AND SECTION OF ELECTRIC HEATER.

iron cast round a coil of pipe. This block is embedded in and covered with a layer of magnesia lagging about 2 in. thick. The top of the block is hollowed out into a cylindrical form, and in this hollow is placed the heating element, consisting of four coils of iron wire insulated with mica. Further economy is effected by introducing between the lagging and the outer cover a small reservoir, which is in turn protected by lagging from the outermost surface of the heater, and which serves for raising slightly the temperature of the incoming water before it is introduced to the heater proper. Since the coil of pipe through which the water passes must have sufficient surface for heating the water when the block is comparatively cool, it follows that when the block is very hot the water will be converted into steam. It is necessary, therefore, to mix the issuing steam with water, and thus reduce it to a suitable temperature. The total energy required for heating a given quantity of water is not less than by other methods; it might even be greater. But while former electric heaters cannot give a big flow of really hot water, unless a considerable current is employed, the new heater is able to supply a comparatively large quantity of hot water with a small current, the power required for a heater giving 25 qt. per day being only 200 watts. The heaters are of importance to central-station engineers, because while the consumer will have to pay for the same number of kw-hours as with other heaters, yet the maximum demand is greatly reduced and the load factor is improved. It is proposed to connect the heater up so that it is automatically cut out of circuit when light is required, so that the total load can be maintained more or less constant. If a heater is made with, say, 10 coils, and these are connected so that they can be

switched out as desired, then if electrical energy is required for any other purpose at any time, a certain number of coils are switched out and the required fan, griller or lamp, as the case may be, is switched on in their place. In this way the load factor of an installation can be greatly improved, and if lighting can be combined with heating to give a really high load factor, the cost of lighting (to the consumer) may be reduced to so low a figure that it is economical to spend more on heating water than would otherwise be the case.—Lond. *Electrician*, Sept. 10.

Electricity on Board Ship.—J. McLaren.—A paper read before the (British) Association of Marine Engineers. The author considers a suction-gas plant and alternator for supplying the electrical energy for operating the auxiliaries on board ship, and shows the great saving which can be effected by such an installation, compared with the usual donkey boiler with its long lengths of steam piping.—Lon. *Electrician*, Sept. 10.

Regulation for Mines.—An account of quite drastic electric mining regulations in force in New South Wales. Reports are to be kept of such accidents as overheating and the appearance of sparks outside enclosing casings of apparatus, and any cases of apparatus becoming live are to be recorded. Trailing cables are to be tested once a month after six hours' immersion in water, the results are to be logged, and no trailing cable must be taken into use if the insulation is less than 1 megohm. The machineman in charge of a coal-cutter must be competent to examine the roof and sides, and to detect the presence of gas. —Lond. *Elec. Eng'ing*, Sept. 9.

Wires, Wiring and Conduits.

Calculation of Transmission Lines.—A. Blondel.—The conclusion of his paper giving a simple graphical method of determining the constants of alternating-current transmission lines by means of diagrams. In the present installment the author discusses the calculation of various transmission lines starting from one common center of distribution.—*La Lumière Elec.*, Sept. 4.

Insulators.—M. Gerstmeyer.—An article discussing the best design of insulators for overhead lines, with respect to high mechanical strength and prevention of perforation. Special attention is paid to the action of rain drops on the insulators.—*Elek. Kraftb. u. Bahnen*, July 3 and 14.

Electrophysics and Magnetism.

Anode Rays.—A. Reichenheim.—An abstract of a paper presented before the British Association for the Advancement of Science on anode rays and their specter. The author demonstrated experimentally the main features of recent researches made by Gehrcke and himself. The experiments are an outcome of Goldstein's researches on canal rays. The ordinary fall of potential at the anode is only about 30 volts, but in the presence of the vapor of a halogen compound, like lithium chloride, the fall is much greater and anode rays are then produced, which show the spectrum of the metal Li with which the halogen Cl is combined. The bulb exhibited had an aluminum cathode at the top, and an anode in a lateral tubular protrusion. The anode consisted of a small cylinder of lithium chloride, mixed with graphite, so as to render it conductive, contained in a glass tube; a wire passed along the tube and entered the fragment of salt. When the current was turned on, the salt melted and evaporated, and the anode rays appeared red; with sodium chloride as the salt they looked yellowish red; with strontium chloride, not deep red, as might be expected from the characteristic color of strontium flames, but rather violet. These anode rays can be deflected both by electric and magnetic fields, their e/m has been determined, the velocity of the rays in centimeters per second is 1.76×10^9 for sodium, 2.4×10^9 for lithium, and 7.08×10^8 for strontium. When the e/m calculated is divided by the e/m for hydrogen, the atomic weights of the metals result, so that the rays consist of metallic atoms. In further experiments the author made use of two glass bulbs connected by a glass tube, of which the ends projected into both bulbs; this tube he called a "bridge." The first bulb contained the anode, an aluminum spiral, placed within a short vertical tube; the second contained the cup-shaped cathode. The bulbs were filled with hydrogen or helium and iodine; the iodine, like other halogens, has a very high absorptive power for electrons. Pencils of helium rays were seen to issue both from the anode and from one opening of the bridge tube. Again, in another apparatus more like the original Goldstein bulb, the cathode was on the upper portion of the bulb, which was provided with a lateral tube, and ended in a chamber containing a wire-gauze cylinder; this tube was closed on the bulb side by the perforated anode, and there was another vertical perforated partition further on. The bulb was charged with a mixture of hydrogen and iodine. Cathode and anode rays and canal rays (in the ordinary sense) were seen to pass in both directions through the tube between the two partitions, the grouping of the rays being symmetrical. The spectra of the anode rays resemble the electric arc spectra, but are simpler than the arc spectra. The spectrum of the strontium rays shows the characteristic red strontium line and two pairs of lines, while on the surface of the anode itself only the first line is visible. The carriers of the anode rays being the charged atoms, it is possible to decide which of the spectrum rays are due to the atom. The Doppler effect is determinable in all the rays.—Lond. *Engineering*, Sept. 10.

Secondary Radiations.—J. C. McLennan.—An abstract of a paper read before the British Association for the Advancement of Science on secondary radiations excited by alpha rays. In order to simplify his study of secondary radiations, he stated he had taken the alpha rays emitted by polonium as his source. But polonium also emitted delta rays, and the research proved that the delta rays were in excess of the alpha rays, as previous experiments had already indicated. He had coated a copper plate with a thin film of polonium and placed a brass plate opposite to it. That brass plate became negatively charged and sent out secondary negatively charged rays. The charge on the brass plate represented the algebraic sum of the delta rays and of the secondary radiation, and the experiments concerned the alterations effected by putting an additional positive or negative charge on either of the plates, and by varying the material of the plate. He had substituted plates of zinc, lead and aluminum for the copper plate, and of lead, silver, zinc, copper and aluminum for the brass plate. One of the chief results of the research was finding that the secondary radiations are little influenced by the material of the (second) metal from which they emanate. Professor Rutherford thought this result remarkable; commenting further upon some peculiar features of the changes in the phenomena, he said that the nature of those positive and negative charges is not understood, and it is best not to trouble about them at present.—Lond. *Engineering*, Sept. 10.

Bar Magnets.—S. P. Thompson and E. W. Moss.—A paper giving the results of an experimental investigation of the self-demagnetizing factor of bar magnets.—Lond. *Electrician*, Sept. 10.

Units, Measurements and Instruments.

Slip-Meter.—F. Horschitz.—An illustrated description of a slip-meter which is quite similar to a speed meter in construction and method of handling. It is attached to the shaft of an induction motor and after a certain time it is taken off. It indicates both the number of revolutions during the time while it was operated and the number of certain galvanometer oscillations during the same time, and from these two readings the slip can be easily determined. The principle is shown in Fig. 2. S and S^1 are two slip rings, and K is a commutator, which has as many segments as the motor has poles. The different segments of the commutator K are connected alternately to the slip rings S and S^1, as shown in the illustration. One brush is provided for each slip ring and two brushes for the commutator. The two brushes of the two slip rings are connected to the two poles of the alternating-current network, while the two commutator brushes are shown to be connected to a Deprez-d'Arsonval voltmeter, which has the zero point in the center and gives equal oscillations on both sides. For a given slip of the induction motor, the needle of the galvanometer will oscillate

regularly, and the slip of the induction motor is a simple function of the number of oscillations of the needle during a certain time and of the number of revolutions which the motor has made during the same time. Both numbers are counted mechanically on the slip meter. Instead of the d'Arsonval galvanometer, a magnetic system, similar in principle, may be used. This slip meter is equally suitable for single-phase or

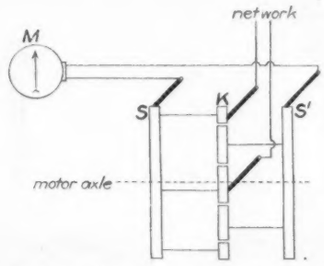


FIG. 2.—DIAGRAM OF SLIP METER.

polyphase motors and permits one to measure slips within a very wide range. It is not more bulky than modern tachometers, but is somewhat longer.—*Elek. Kraftb. u. Bahnen,* Aug. 28.

Analysis of Periodic Waves.—O. MADER.—An illustrated description of a simple and comparatively inexpensive mechanical device for the analysis of periodic waves. It is designed to be used instead of mathematical or graphical analysis. The device combines simple construction with ease of operation and sufficient accuracy for use in practice.—*Elek. Zeit.,* Sept. 9.

Telegraphy, Telephony and Signals.

Non-Uniform Circuits.—DE PIRRO.—The conclusion of his mathematical paper on non-uniform telegraph and telephone circuits. The author shows how the general formulas developed in former experiments can be simplified for special cases. As one of the chief results of his paper he concludes that the consideration of the single constant of attenuation is not sufficient and that all the constants of the circuit must be taken into consideration. He emphasizes the importance of standardization of telephone apparatus and lines.—*La Lumière Elec.,* Sept. 4.

Loading Coils.—With reference to the opposition to the grant of a British patent, two similar systems of loading coils for telephone and telegraph cables are described. In both cases the coils are wound longitudinally, practically parallel to the length of the cable, and there is an iron core between the inner and outer turns of the coils. In one case this iron core is made up of a layer of iron wires, and in the other it is described as an iron cylinder and flexible distance-pieces are inserted between adjacent coils.—Lond. *Elec. Eng'ing,* Sept. 9.

Selective Call.—An illustrated description of a selective-call system in telegraph stations used by a British company. It is employed to call up any distant station, up to a certain number, without ringing up all the intermediate stations. The apparatus is so arranged that it will not respond to ordinary Morse signals. In order to operate it, the circuit must be closed for at least three to four seconds; after that, short current impulses are given, corresponding in number to the number of the station required; finally, the circuit is closed again for about 10 seconds. The last operation causes the bell to ring at the selected station. The current impulses which are then given, being ordinary Morse signals, restore all the selective calls on the line to their normal condition.—Lond. *Electrician,* Sept. 10.

Inductance and Resistance.—J. W. NICHOLSON.—A mathematical paper giving formulas relating to the inductance and resistance of telephone and other circuits.—*Phil. Mag.,* September.

Miscellaneous.

Laboratory Appliances.—W. VOLKMANN.—An illustrated description of various appliances for use in physical laboratories, including cheap series resistor (essentially an asbestos and German silver wire netting) for arc lamps, for optical experiments. —*Phys. Zeit.,* Sept. 15.

NEW APPARATUS AND APPLIANCES

Transmission Circuit for Telephone Train Dispatching.

The use of the telephone for the handling of trains is not by any means new. For several years a number of railroads have been using the ordinary local battery, bridged telephone for this purpose, the various stations being called by code ringing. This arrangement was found to serve very well for short lines

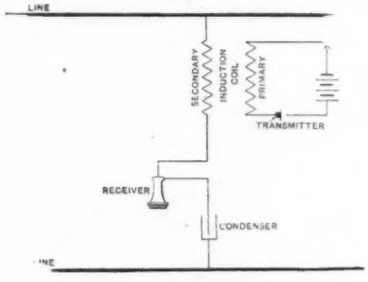


FIG. 1.—ARRANGEMENT OF LOCAL-BATTERY TELEPHONE.

with not very many stations. When the attempt was made to use this arrangement on longer lines with a larger number of stations, it was found that the transmission would be seriously impaired when one or more of the receivers were off from the hook at the same time. This difficulty was very noticeable later on, when selectors began to be used and the telephone was introduced upon the more important and busier roads.

Fig. 1 herewith shows schematically the usual arrangement of a local-battery telephone. Originally this arrangement was used at both the dispatcher's and way stations. From the sketch it will be seen that the bridge during conversation consists of a condenser, receiver and secondary of the induction coil in series. The total impedance of this bridge to talking currents is approximately 600 ohms, about 300 ohms of which are in the receiver and, therefore, active for receiving pur-

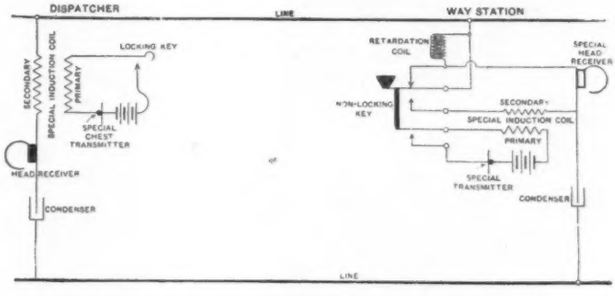


FIG. 2.—CIRCUITS FOR TELEPHONE TRAIN DISPATCHING.

poses. It is obvious that when a number of these sets are bridged across the line at once the joint impedance of the bridges in parallel is very low and the transmission correspondingly difficult between terminals or widely separated stations.

An improvement on this arrangement, so far as transmission is concerned, was effected by using a larger induction coil having a low-impedance primary and a high-impedance sec-

ondary. The larger coil improved the outgoing transmission considerably, but this arrangement is not so efficient for receiving, so that the gain resulting was not great.

To meet conditions imposed by this class of service, the circuit shown schematically in Fig. 2 has been devised. The dispatcher's equipment is substantially the same as shown in Fig. 1, except that special apparatus is used. The dispatcher is provided with instruments of fairly low impedance. Use is made of a head receiver in series with the induction coil; the latter is specially designed to give the best transmission consistent with good receiving. A locking transmitter key is provided, inasmuch as the dispatcher will ordinarily require both hands for his work. The transmitter itself is of the chest type, especially designed for this purpose.

It will be noted that the way-station circuit is radically different from that shown in Fig. 1. In order that a number of stations may be listening at once without serious detriment to the transmission, it is apparent that each must constitute, when listening takes place, a bridge of very high impedance. Further, in order to give efficient receiving, a large proportion of this impedance must be in the receiver itself. This precludes the possibility of having the receiver in series with the induction coil, because when transmitting all the secondary talking current passes through the receiver. The high impedance of the receiver would cut down the transmitted current, and, in addition to this, there would be the serious objection of excessive side tone.

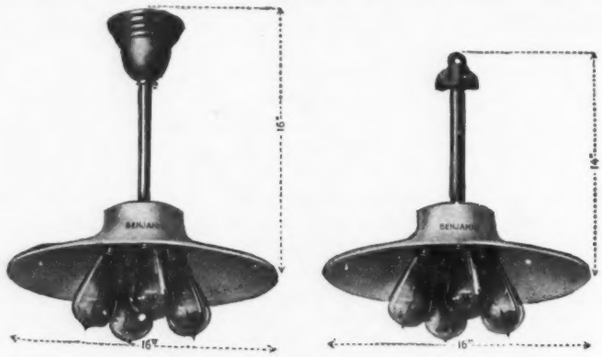
A study of these conditions led to the conclusion that the use of a push button or key which in its normal position gives the best possible receiving conditions and in its operated position gives the best possible transmitting would be advisable. By referring to Fig. 2 it will be noted that in the listening condition there is a circuit through the receiver and condenser in series directly across the line. When the key is thrown to the talking position it is seen that the receiver in series with a retardation coil (normally short-circuited) is put in parallel with the secondary of the induction coil, and these are bridged across the line through the condenser.

When the key is normal the receiver is directly across the line through a condenser, which gives the best possible receiving conditions. The receiver is specially wound and the impedance of the bridge at this time is about 2400 ohms to talking current, practically all of which is in the receiver, and consequently active for receiving. When the key is operated the induction coil, being bridged directly across the line through the condenser, gives the best possible condition for transmitting. The function of the retardation coil is to prevent excessive side tone in the receiver when talking, also by raising the impedance of the receiver circuit, more of the transmission is forced upon the line. This retardation coil is so designed that in case the dispatcher wishes to break in, a sufficient volume of the dispatcher's voice current will pass through the receiver to attract the operator's attention.

This circuit is said to be in use on circuits up to over 200 miles in length, with as many as 45 stations; 20 of these stations can be listening simultaneously without seriously impairing the transmission on the line. The circuit arrangements described above were designed by the Western Electric Company. In the issue of the *Electrical World* for Sept. 16 the circuits were illustrated in connection with a composite telephone set used by a steam railroad. The circuits are intended for train dispatching, but have no direct bearing on composite operation with telegraph lines.

Tungsten Fixtures with Hooded Enameled Steel Reflector.

The illustrations herewith show a new tungsten fixture with hooded enameled steel reflector, now being placed on the market by the Benjamin Electric Manufacturing Company, Chicago. The fixtures are, as will be seen, built up around a Benjamin cluster. They have a 16-in. white-enameled steel reflector, deeply hooded to receive the cluster in such a manner that the lamps are in proper relation to the reflecting surface. The outlets are at an angle of 16 deg. to the vertical. This slight angle not only does not endanger the filament of the lamps but adds materially to the lighting efficiency of the fixture inasmuch as one-half of the light of each lamp is directed downward and the other half at the same angle upward, to be redirected by the



FIGS. 1 AND 2.—TUNGSTEN FIXTURES.

reflector. Thus very little of the light of one lamp passes through the other lamps.

The cluster body is attached to the reflector by means of a flange. A water-tight joint is secured by the use of two rubber gaskets. These flanges are furnished for ⅜-in. or ½-in. pipe, the former for indoor, the latter for outdoor work. Two-light and four-light fixtures take 100-watt lamps, and five-light fixtures, 40-watt or 60-watt lamps. They are made for either multiple or series use.

Test of Moore Tube Lamp.

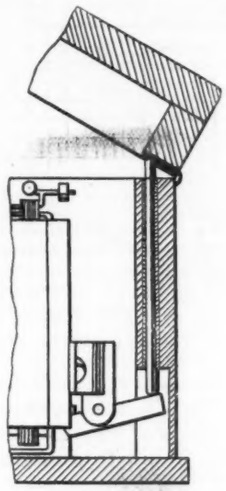
The Moore Electrical Company, Newark, N. J., has received the following report from the U. S. Bureau of Standards on tests made at the Bureau of the Moore carbon dioxide tube lamp: "Tests that were made by Dr. Ives during June showed that the light of this tube contained relatively more blue than the light from the sky near the horizon, and very much less blue than the light from the zenith when the sky is clear. It follows from this that the Moore carbon dioxide tube would be found to contain the same proportion of blue to red as the light from the sky at some altitude between the horizon and the zenith when the sky is clear, the particular altitude depending upon how dry the atmosphere is at the time of the measurement. In other words, the carbon dioxide tube is nearly the average of the light from the clear sky, but as this varies from time to time, according to the clearness of the sky and the dryness of the atmosphere, it is impossible to give the value of average daylight in exact figures."

Power Equipment for Drawing-in Cables.

The Cleveland Electric Illuminating Company, Cleveland, Ohio, has in use a power equipment which has been found especially convenient in drawing cables through conduits in the streets. It is built upon a short, heavy truck which may be coupled to a wagon when going from one point to another. In the front of the enclosure a Lincoln compound-wound motor is bolted to the heavy underframe. This has a speed range of 825 to 500 and sufficiently shunt to prevent its running away. The motor is geared to a shaft, which in turn is geared to a speed shaft which operates the drum. From the gear mesh, two speeds, 25 ft. and 50 ft. per minute, are obtained, a shifting lever being used to make the change. With the winch a speed of 30 ft. per minute drawing a 2,000,000-circ. mil cable may be obtained. Direct-current energy is obtained from the manholes in districts thus supplied, but where the territory is furnished with alternating current, energy is obtained from a battery.

Galvanometer Protecting Device.

The accompanying illustration shows an automatic clamp for the delicate suspension of a portable testing instrument. The clamp is so arranged that when the lid of the containing case is closed the moving element is lifted entirely free from contact with the pivot point and jewels, but as the cover is opened the system automatically returns to its initial position, thereby



GALVANOMETER PROTECTING DEVICE.

maintaining its initial sensibility and retaining the pivots and jewels uninjured, regardless of the mechanical treatment to which it is in the meantime subjected. This clamp has been devised by Queen & Company, Philadelphia, Pa. It can be applied to many of the existing types of galvanometers constructed by this firm.

Automatic Oil-Switch.

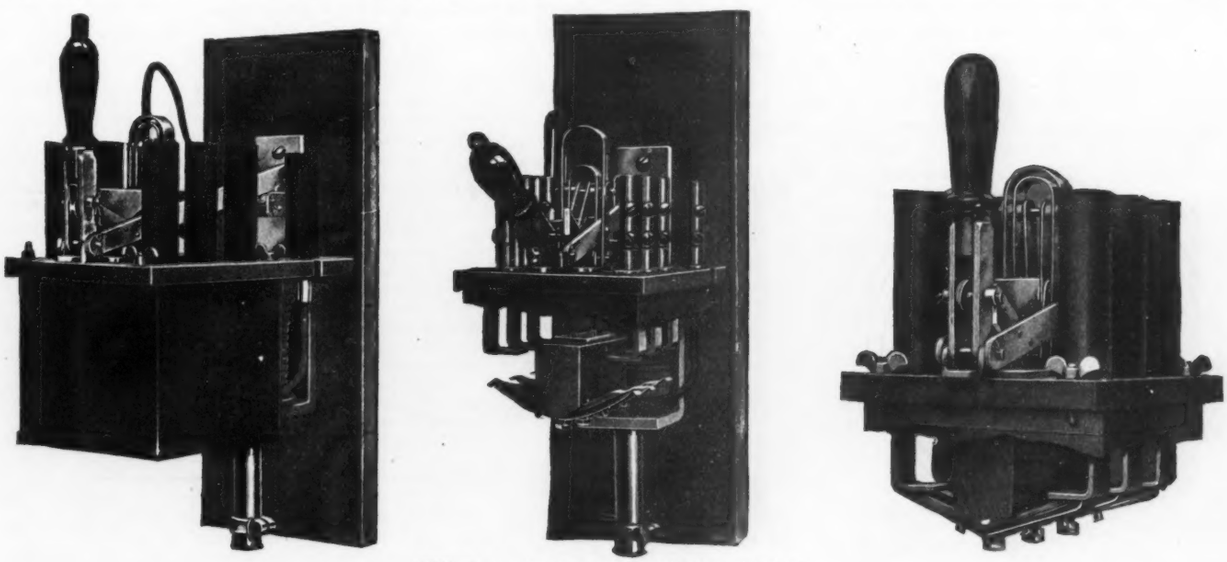
Due to the inherent quality of a three-phase motor to run single phase when once started, the custom of protecting such motors by some device which is sure to open all poles in case of an overload has rapidly grown. Such a device in the form of an automatic oil switch is shown in the accompanying illustrations, made by the Condit Electrical Manufacturing Company, of Boston, and being known as an "LS" switch. This is provided with a coil and automatic release from the handle mechanism and is so arranged that an overload will open all of the poles. Referring to the mechanical features of the switch, it will be noticed that the current-carrying parts are laminated brushes. These have become a standard on direct-current circuit-breaker work, and are equally suited for carrying current in oil switches. It is recognized that nothing is superior to a laminated brush as a current-carrying member, and, when properly protected with secondaries, a current-breaking member. The switch is rugged and substantial and is so arranged that it is impossible to hold it closed on an overload.

Pliable Insulating Material for Floors.

The Electrose pliable insulating flooring, recently invented by Mr. Louis Steinberger, and placed on the market by the Western Electric Company, is a new development and is being used extensively in connection with high-tension switchboards. It is also used as a protective covering for floors and walls adjacent to high-tension apparatus. This insulating flooring possesses not only high dielectric properties, but also has a uniform composition. On an official test, a slab 12 in. x 12 in. x 3/8 in. arced over at 89,000 volts without puncturing, which gives an idea of its dielectric strength. The material is permanently pliable, very tough and strong, thoroughly waterproof and possesses a dull surface which will not become smooth or slippery from wear. It is made in various colors and of practically any size or thickness.

The material conforms to any inequalities of a floor upon which it is laid, and while the standard form of the material is pliable, it can be made, if desired, very hard and inflexible. When installing the covering, the slabs are placed on the floor or secured to a wall and spaced about 1/4 in. apart. A cement, made of the same material, is then poured, or otherwise applied, between the slabs. When this cement "sets" (which will occur within 10 minutes of the time of application) a homogeneous mass is formed which becomes an integral part of the slab.

The Electrose flooring may be sawed, planed or drilled, and nails may be driven through it without danger of cracking or otherwise injuring it. The material naturally clings to the floor or other surfaces upon which it is laid, and does not curl at the edges or corners, thereby not making it necessary to secure the material to the floor, except under certain conditions, as when the slabs are small and it is necessary to keep them from moving along the surface of the floor. It is stated that in those cases where the Electrose pliable insulating flooring has been laid in power stations having high-tension switchboards, it has given thoroughly satisfactory results.



FIGS. 1, 2 AND 3.—AUTOMATIC OIL SWITCH.

Small Motors.

The General Electric Company has recently placed on the market a new line of alternating-current and direct-current fractional horse-power motors. These have been termed the "drawn-shell" type, due to the fact that they have their field and stator iron securely bound in shells drawn from plates of steel.

The fields of the direct-current motors are built up of punchings, a construction which secures much smaller diameters than is possible with the usual cast-steel or iron magnet frames. The field and stator punchings are assembled under compression, with thick punched rings to serve as spacers for the end turns of the winding, and the whole is pressed into a steel shell. The edge of the shell is spun over securely, holding the iron in place. This construction is shown in Fig. 2.

These steel shells or frames for both direct-current and alternating-current motors are cylindrical, and have no lugs or projections whatever. They are placed on an arbor and the rim is trued and grooved to receive the heads, which are made of cast-iron. The heads are machined on centers to fit the frame, consequently the whole structure of the motor is correct, and accurate air-gap and alignment of bearings are the result.

The standard base is shown in Fig .1, and this is securely held in place by two screws tapped into the magnet frame. The shafts of all motors are of ample size, and the bearing linings are of bronze. The induction motors have a high power factor, efficiency and liberal overload capacity, with moderate heating. This is evident from the curves in Fig. 4. The windings are of the concentric type, and the starting coils are automatically cut out by a switch when the motor has reached a suitable speed. A centrifugal clutch is furnished when necessary.

Since the frames are cylindrical and without lugs and projections, they may be fitted with ease to any form of support, and the heads may be turned through any angle to permit of the motor being inverted or attached to a wall or vertical bracket. This method of construction eliminates the outside frame of cast iron that is usually employed, as well as the necessity for all holes through the active iron. It also makes possible accurate methods of manufacture, which ensures perfect concentricity of parts and an alignment not usually found when the common cast shell is used.

These motors are supplied to meet all commercial circuit conditions of voltage, and, in the case of the induction motors, are supplied for the various frequencies with either single or polyphase winding. If one wishes to have direct-current and alternating-current motors of the same dimensions so as to use them interchangeably, it will be necessary to interchange an alternating-current with a direct-current motor of the next larger capacity. Their electrical characteristics are clearly shown by the curves in Figs. 3 and 4.

The motors are very compact, light in weight and of fine workmanship. They are adapted to such service as driving sewing-machines, small lathes, automatic musical instruments, air pumps, small blacksmith forges, dental instruments, jeweler's tools, pumps, buffing and grinding tools and a large variety of small special machines.

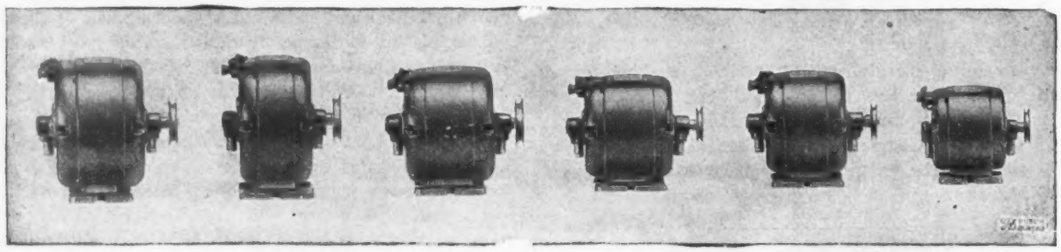


FIG. 1.—COMPLETE LINE OF ALTERNATING-CURRENT MOTORS.

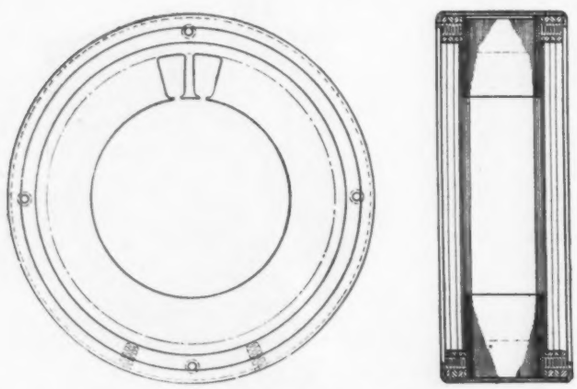


FIG. 2.—MOTOR FIELD STRUCTURE.

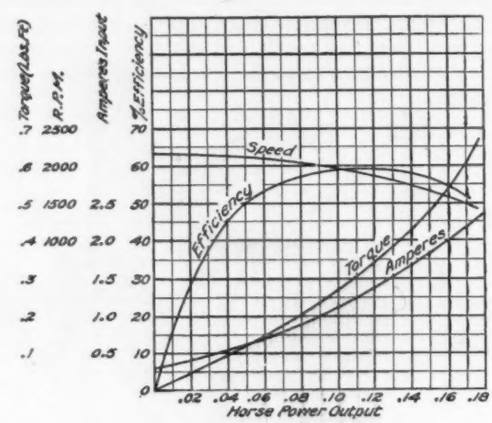


FIG. C.—TYPICAL CURVES OF DIRECT-CURRENT MOTORS.

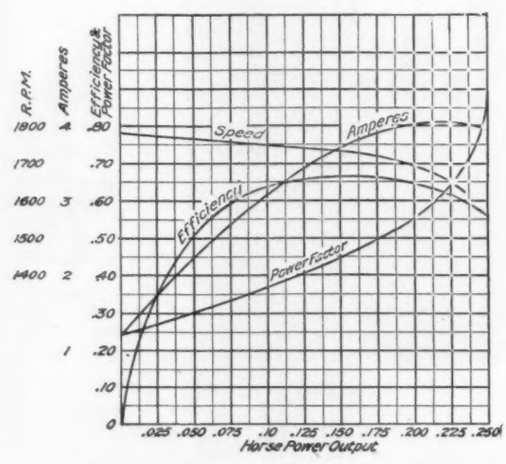


FIG. 4.—TYPICAL CURVES OF ALTERNATING-CURRENT MOTORS.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

General improvement in trade continues throughout the country, and this is especially noticeable in the retail business. The shipments of crops have been heavy in many sections of the West, producers have received their money and the natural consequence is active buying from the retail stores. Among the wholesalers and jobbers orders are not particularly plentiful, but as this is a season at which orders are always slack there is no discouragement felt upon this account. The spring orders that are being placed continue to show that spirit of conservatism which was so noticeable when the orders for fall goods were placed. It is evident that business men of the country are determined not to overstock. The industrial lines continue to lead in activity, and especially in the iron and steel industry orders are almost too numerous to be filled. One result of this is that there are few skilled workmen now idle, and the general employment of all kinds of labor continues to expand. All of this is adding to the prosperity of industrial sections. The crop situation is unchanged, and it is still figured that the producers of the country will receive about eight billions of dollars for their product. Collections are very much improved, and, in fact, are entirely satisfactory. Business failures for the week which ended Sept. 23, as reported by *Bradstreet*, were 171 against 198 of the previous week; 267 in the like week of 1908; 166 in 1907; 165 in 1906, and 185 in 1905.

THE COPPER MARKET.

There has been more activity in the copper market during the past week and prices are distinctly stronger. Such an advance was predicted in the market 10 days ago when there began to appear artificial stimulation in copper speculation in London. This manipulation was especially directed toward November and December deliveries, but it also had a distinct effect upon the spot and October market. Quite a number of liberal contracts from exporters and from domestic consumers have been reported. The domestic buying was rather spasmodic and gave no indication of a desire on the part of consumers to accumulate stocks. Indeed, it is generally understood in the market that the principal users of copper are fairly well stocked and are not much afraid of any dangerous boosting of prices. The statistical position, which is perfectly well understood by the consumers, continues to deny the possibility of a marked advance. Production goes on at a record-breaking rate and actual consumption is below normal. Stocks are accumulating in warehouses and in consumers' hands as well as with the producers. Regardless of "sales" and the shifting of holdings, the discrepancy between production and consumption continues. Exports for the month, including Sept. 27, were 13,593 tons. The daily call on the Metal Exchange, at 12:30 o'clock Sept. 27, quoted standard copper as follows:

	Bid.	Asked.	Settling price.
Spot	12.65	12.75	.....
September	12.65	12.75	12.70
October	12.70	12.80	12.77½
November	12.80	12.85	12.82½
December	12.90	13.00	12.95

The London prices Sept. 27 were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	59 10 0	59 10 0
Standard copper, futures	60 6 3	60 7 6
Market	Firm.	Steady.
Sales of spot		600 tons
Sales of futures		800 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.00	12.62½
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6

CALIFORNIA ELECTRIC FUSE FACTORY.—The Long Beach Electrical Manufacturing Company, Long Beach, Cal., is erecting machinery for the manufacture of a new type of electric fuse.

CENTRAL LABORATORY SUPPLY COMPANY, PURDUE, IND., CHANGES NAME.—On account of the greatly increased scope of the business done by the Central Laboratory Supply Company, the directors voted at their August meeting to change the name of the company to the Esterline Company. The Central Laboratory Supply Company was organized in 1903 by J. W. Esterline, and began manufacturing a line of electrical, mechanical and physical laboratory apparatus. In 1906 the company was incorporated, with J. W. Esterline, W. Bent Wilson, Thomas Duncan and E. S. Ferry as the principal stockholders. The company has been prosperous and has had a rapid growth, numbering among its customers nearly all the leading technical and commercial laboratories in the United States and Canada. In addition to its manufacturing work the company has continued the consulting engineering work formerly conducted by Mr. Esterline, and has been successful in the design and construction of lighting and power plants and modernizing of manufacturing establishments. On account of the increasing volume of business in this line, the directors have decided to change the name of the corporation, and also to increase the engineering staff of the company. J. W. Esterline, president and manager, will continue at the head of the consulting engineering staff. It is the purpose of the company to enter more largely into construction work, and to this end has secured the services of B. W. Bissell, an engineer of ability in contracting and construction work, now in the employ of the Government at Highland Falls, N. Y. Mr. Bissell will take up this work Oct. 1. Mr. Berdon, an electrical engineer and expert in switchboard and instrument design, has been appointed assistant manager. A. J. Webber is at the head of the design and drafting department. Mr. Webber was also until recently in the Government service, and is experienced in machine and power plant design. E. L. Ogle, a graduate of Purdue University, class of 1903, engaged since graduation in electrical construction work, has also been recently engaged by the company. With a staff of five experienced engineers, headed by Mr. Esterline, this company is in a position to handle successfully its rapidly growing business in engineering and construction. The company has just completed a 1000-kw combined steam and water-power plant for the city of Logansport, Ind.; a 1000-kw station for Frankfort, Ind., and has recently closed the following contracts: Indiana Springs Company, Kramer, Ind., power plant and motor equipment; Indiana State Soldiers' Home, electric lighting plant and motor equipment; C. H. Campbell Furniture Company, Shelbyville, Ind., electric generating plant and motor equipment; DePauw University, Greencastle, Ind., heating system and lighting plant. The company has recently been employed to design and construct a large hydroelectric plant and transmission system. The Esterline Company will continue manufacturing the well-known line of electrical instruments, graphic meters and special apparatus which have been marketed by the Central Laboratory Supply Company.

NEW HIGH-POWER WIRELESS PLANT.—Marconi announces that he has recently superintended the reconstruction of the wireless station at Glace Bay, N. S. The plant when completed will be one of the most powerful wireless telegraph stations in the world, and new instruments have been devised for its equipment. It is believed that when it is ready for operation there will be no interruption in the service between Nova Scotia and Europe.

TUNNEL UNDER THE CHICAGO RIVER.—Geo. W. Jackson, Inc., of Chicago, has put in a bid offering to build the main section of the proposed Washington Street street-railway tunnel under the South Branch of the Chicago River for $590,000. It is said that this bid was much lower than that of the next lowest bidder, and that Mr. Jackson's company will undoubtedly get the contract as soon as the necessary papers are made out.

GENERAL ELECTRIC TOLEDO PLANT.—Work has been commenced on a $100,000 addition to the Toledo lamp plant of the General Electric Company.

ALLIS-CHALMERS ORDERS.—The Allis-Chalmers Company has recently received orders for steam turbines aggregating a total of 25,255 kw, and the large numbers of "repeat orders" received by the company testify to the economical and reliable operation of the units in service. Recent contracts for new machines comprise turbines ranging from 300 kw to 3000 kw for generating current in a great variety of industries. Among the purchasers of large units are the Wilmington (Del.) City Electric Company, 1500 kw, and the Paine Lumber Company, Oshkosh, Wis., 1000-kw and 500-kw turbines. The Diamond Rubber Company, of Akron, Ohio, has purchased a 1250-kw, low-pressure turbine. Sales of 500-kw turbines have been made to Byron Weston Company, Dalton, Mass.; Sheffield Car Company, Three Rivers, Mich.; E. J. Du Pont De Nemours Company, Wilmington, Del.; Coventry Company, Anthony, R. I.; Alexandria Electric Company, Alexandria, Va., and two units for the Casparis Stone Company for operation in its plants at Patterson's Creek, W. Va., and Harve de Grace, Md. The National Conduit & Cable Company, Hastings-on-Hudson, N. Y., has bought a 750-kw turbine, and the Ponemak Mills, Taftville, Conn., have contracted with Allis-Chalmers Company for a 600-kw turbine. Two 375-kw low-pressure turbines are to be installed in the plant of the Cherry River Paper Company, Richmond, Va., and one in the plant of the Virginia Electric Power & Water Company, Virginia, Minn. The Taylor Iron & Steel Company, Highbridge, N. J., will put in operation a 300-kw Allis-Chalmers steam turbine. Sales for turbines of the same capacity have also been consummated with the Noblesville Heat, Light & Power Company, Noblesville, Ind.; Citizens' Lighting Company, La Salle, Ill.; Huntington Valley Light & Power Company, Jenkintown, Pa., and the Pacific Lumber Company, Wilmington, Cal.

CROCKER-WHEELER COMPANY'S ORDERS.—Several large orders for direct-current apparatus have recently been received by the Crocker-Wheeler Company. Among these is one from the Southern Iron & Steel Company, of Roger, Ga., calling for two 250-kw, engine-type, 550-volt, direct-current generators and 275 hp in 500-volt, direct-current motors. This is in addition to a recent order for 1450 kw in engine-type generators and 1200 hp in slow-speed motors from the same concern. The Republic Iron & Steel Company, Youngstown, Ohio, placed an order for a 600-kw, engine-type, 250-volt, direct-current generator, which will be added to a plant consisting of two 300-kw Crocker-Wheeler generators. Another order has been booked from the Nonquit Spinning Company, New Bedford, Mass., covering 375 kw in 250-volt, type-D, direct-current generators. One 250-kw, 250-volt, engine-type, direct-current generator, and two 50-hp motors are to be installed in a woolen mill for the Southwark Mills Company, of Philadelphia. Two 75-kw, engine-type, 125-volt, direct-current generators will be installed in the factory building of Goodman, Loeb & Company, Philadelphia, Pa.

CONDITION OF PLATINUM MARKET.—Cyrus Osborne Baker, president of Baker & Company, dealers and refiners of platinum, has recently returned from abroad. While Mr. Baker's trip was largely in search of health, and not for business, he says that he found the situation of the platinum market in Europe to be about the same as it has been for some months past, and that the price of platinum, which is quoted at from $26 to $27 an ounce, has not changed for several months. Mr. Baker says that a proposition is before the Russian Government for an arrangement by which the Imperial Bank of Russia will advance money up to a certain limit upon platinum for the benefit of the miners. Such a policy as this would be beneficial to the dealers and consumers of platinum in this country, in so far that it would steady the price, fixing a limit below which it would not be likely to go. Mr. Baker returns after a rather serious illness, very much improved in health.

ELECTRICAL PROGRESS IN EUROPE.—E. W. Rice, vice-president of the General Electric Company, returned from Europe last week and declared that electrical development abroad was progressing very satisfactorily. "Progress is not so great as in this country," said Mr. Rice, "and the adoption of electrical appliances is slower. I expected to find railroad terminals, especially in the large cities, applying electricity, as is being done in this country, but such is not the case. The application of electricity for terminal purposes must come sooner or later in such cities as London, Manchester, Birmingham, Glasgow and other large cities. The smoke nuisance is terrible in those cities, and in some of the long tunnel approaches. It is more a disinclination to depart from the old custom than a question of expense that delays the change, but it will surely come soon."

BERLIN AMERICAN EXPOSITION.—Secretary Nagel, of the Department of Commerce and Labor, has sent out a circular to manufacturers, boards of trade, etc., asking their support of the American Exposition, to be held in Berlin, Germany, from May to July, 1910. As the exposition is to be confined strictly to American products, it becomes, he says, a matter of national interest to have the exhibits thoroughly comprehensive and of exceptional merit, so that the exposition may serve to strengthen the prestige of American industries abroad. The office of the exposition is at 50 Church Street, New York.

ILLINOIS CENTRAL ELECTRIFICATION.—Within a short time all of the Illinois Central tracks within the city limits of Chicago will be ready for electrical operation. The electrification will proceed in six sections, namely: First, suburban tracks, Randolph Street to 63d Street, from steam to protector third rail; second, express tracks to South Chicago, third rail; third, electrification Kensington tracks; fourth, electrification suburban and through passenger tracks to Burnside; fifth, passenger and freight tracks between Park Row station and Burnside; sixth, passenger and freight tracks to Riverside.

DILG MANUFACTURING & TRADING COMPANY.—The Dilg Manufacturing & Trading Company, 401 East 163d Street, New York, has organized an electrical department for the manufacture and sale of motors, dynamos and electrical sundries, and to furnish expert engineering advice and designs. C. H. J. Dilg, formerly of the Eck Dynamo & Motor Company, will be in charge, and has already introduced a number of labor-saving devices and improvements. H. O. Allen, electrical engineer, also formerly with the Eck Company, will be on the staff of the new department.

GOOD DEMAND FOR INSULATED WIRE.—Dealers in insulated wire for interior use report that the demand has become quite active, and that there are many inquiries, which indicate that the business will be even better later in the fall. There has been a great amount of building done during the present season, and these buildings are now nearing a point where wire contracts are in order. Building of this sort has been largely of the better class, and iron and steel construction and all of this kind of work add to the trade in insulated wire.

NIAGARA FALLS HYDRAULIC POWER & MANUFACTURING COMPANY.—The Water Commission of Niagara Falls has accepted the offer of the Niagara Falls Hydraulic Power & Manufacturing Company for the municipal waterworks pumping plant. The purchasing company agrees to supply energy up to 800 hp, for a term of 76 years, to the city at a rate of $9 per horse-power per year, and all above that amount at $10 per horse-power. The offer from the Niagara Falls Power Company was $20 per horse-power.

HEANY LAMP COMPANY.—The Heany Lamp Company is just completing the equipment of its new factory at Flint, Mich. The capacity at the start will be 10,000 tungsten lamps per day, which will be increased as rapidly as new machinery can be installed. The Heany Company will shortly begin the erection of another lamp factory in the vicinity of New York, to have a like capacity. These various increases in plant are rendered necessary by the enormous demand for Heany tungsten lamps.

CITIZENS' RAILWAY & LIGHT COMPANY, MUSCATINE, IA.—A contract has been placed with the Westinghouse Electric & Manufacturing Company by the Citizens' Railway & Light Company, of Muscatine, Ia., for one 750-kw turbine and one 300-kw rotary converter. These are to be installed in the generating plant of the company at Muscatine.

CATALOGS WANTED.—The Madison County Gas & Electric Company, Oneida, N. Y., writes that in a fire which recently destroyed its offices all files of catalogs were consumed, and it would like to receive trade literature from manufacturers of electric and steam apparatus and specialties.

NEW PLANT IN LOUISVILLE, KY.—The Bradford Worsted Spinning Company, of Louisville, Ky., has drawn plans for a new power plant which will include four 200-hp tubular boilers and a 700-hp Hamilton-Corliss engine direct connected.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Crowley, La.; Willard, N. Y.; Bear Creek, Mont.; Sweetwater, Nev.; Weston, Ore.; Dayton, Ore.; Denison, Ohio; St. Catherines, Ont., Can.; Jefferson, Ga.; Dillon, S. C.; Orangeburg, S. C.; Bellingham, Wash.; Tyndall, S. D.; Washtunca, Wash.; Hoboken, N. J.; Detroit, Mich., Point Richmond, Cal.

Financial Intelligence.

THE WEEK IN WALL STREET.

After a more or less irregular market during the days that preceded the Wall Street holiday of Sept. 25, there was considerable strength developed Sept. 27, although trading was not active. The market in this instance seemed to be carried up by the tremendous desire to buy Steel common. There is apparently an abiding faith in the prediction that this stock will reach par. The price on Sept. 27, the last day under review, was pushed up to 87⅛, a new high record. Although the stock market during the week had been irregular with an inclination to weakness, this has been the result of general liquidation by long holders rather than of any discouraging features in the situation. As a matter of fact there is nothing discouraging in sight. The crop situation is entirely satisfactory and industrial conditions, especially in iron and steel, are better than ever before in the history of the country. Railroads as well as industrials are doing splendidly and money continues to be easy enough to make the carrying of securities easy. The record of dividend disbursements for October is in itself an indication of conditions. The total increase over last year is figured at $13,274,000, and this of course only represents a limited number of the principal corporations. The demand for bonds, while good, is not so heavy as it was when stocks were less attractive for investment purposes. Money continues easy. Quotations Sept. 27 were: Call 2¾ @ 3 per cent, 90 days 3¾ @ 4 per cent. The quotations in the table are those of the close Sept. 27.

NEW YORK.

	Sep. 20.	Sep. 27.	Shares sold		Sep. 20.	Sep. 27.	Shares sold
All.-Ch.	15⅛*	15⅜	2,100	Int.-Met., pfd.	48⅜	48⅛	14,448
All.-Ch., pfd.	54*	53½	1,525	Mackay Cos...	88½	91½	12,900
Amal. Cop....	84½	82	115,750	Mackay Cos.,p.	75½	76	3,470
Am. D. T....	20½*	20½*	——	Man. Elev....	143¾	142	410
Am. Loc.	61	59½	5,400	Met. St. Ry..	20*	143¾*	——
Am. Loc., pfd.	118½	117	750	N.Y.&N.J. Tel.	139¼*	139½*	——
Am. Tel.&Cbl.	84¾*	85*	100	Steel, com....	84	86½	837,400
Am. T. & T..	143	144⅛	37,450	Steel, pfd....	128¼	128½	75,260
B. R. T.....	80⅛	79¾	55,175	W. U. T.....	78¾	79¾	16,500
Gen. Elec.....	167¾	168	3,150	West'h, com..	87	86¾	5,800
Int.-Met., com.	14⅞	14¾	7,865	West'h. pfd...	130*	135	200

PHILADELPHIA.

	Sep. 20.	Sep. 27.	Shares sold		Sep. 20.	Sep. 27.	Shares sold
Am. Rys.....	46	45⅞	——	Phila. Elec....	12½	12⅜	——
Elec. Co.of A.	12¼*	12¼*	——	Phila. R. T...	27	28⅛	——
Elec. St. B'ty.	62	59½	——	Phila. Trac....	88½*	90	——
E. S. B'ty,pfd.	30*	30*	——	Union Trac...	52¾	53½	——

CHICAGO.

	Sep. 20.	Sep. 27.	Shares sold		Sep. 20.	Sep. 27.	Shares sold
Chi. City Ry..	180*	180*	——	Chi. Tel. Co..	138*	138	——
Chi. Rs.,Ser.1.	110*	109¾*	——	Met. El., com..	16	17¾*	——
Chi. Rs.,Ser.2.	36¾*	36½*	——	Met. El., pfd..	49½	51	——
Com. Edison..	120	120¾	——	Nat'l Carbon..	96¾	96½	——
Chi. Sub'ws...	9⅛	9¼	——	Nat'l C., pfd..	118½*	119*	——

BOSTON.

	Sep. 20.	Sep. 27.	Shares sold		Sep. 20.	Sep. 27.	Shares sold
Am. T. & T...	143⅜	144½	——	Mex. Tel.....	3*	2¼*	——
Cum. Tel.....	145*	140*	——	Mex. Tel., pfd.	6	6*	——
Edison E. Ill..	252	252	——	N. E. Tel.....	139	138½*	——
Gen. Elec.....	168	167¼	——	W. T. & T....	11	11⅜	——
Mass. E. Ry..	17*	16¼*	——	W. T. & T., p.	90	88	——
Mass. E. R.,p.	79½	78¼	——				

*Last price quoted.
Shares sold are for week of Sept. 20 to Sept. 24.

DENVER GAS & ELECTRIC COMPANY.—Plans for an issue of $25,000,000 in 40-year 5 per cent bonds by the Denver Gas & Electric Company have practically been matured, and the bonds will probably very soon be ready for the public. It is not contemplated, however, making at the present time any offering of these bonds for sale. The Denver Gas & Electric Company has a large surplus in actual cash, and is not in need of money, and further than the bonds that are necessary to take up the outstanding liabilities there will be no issue at this time offered to the public. H. L. Doherty & Company, who are back of this company, and who have planned the present refinancing, are merely building for the future, and the bonds will be disposed of as money for additions and extensions is needed. It has not been announced as yet what the capitalization of the reorganized company will be, but as the present company is in splendid shape this is not material. In this connection it is said that a merger of the Denver Gas & Electric Company, the Central Colorado Power Company, the Northern Colorado Power Company, the Denver Tramway Power Company, the Pueblo Light & Traction Company and the Colorado Springs Hydro-Electric Company is being planned. At the present time no definite information regarding this merger is being given out. Frank W. Frueauff, general manager of the Denver company, has denied some of these rumors, but he would not deny the possibility of such a combination in the future. The Denver company is now taking part of its power from the Shoshone plant of the Central Colorado company, and will take another large portion of its power from the Nederland plant, near Boulder, Col., when that is completed. The reliability secured from having two water-power sources as well as a steam station, which will be maintained, is expected to be very valuable to the service.

WORCESTER ELECTRIC LIGHT COMPANY.—Stone & Webster, of Boston, sent out last week through Kingsley & Adams, brokers, offers to pay $300 cash for each share of stock of the Worcester Electric Light Company. This is one move in a big struggle that is now going on for control of this property. Since the New Haven railroad took over the Worcester Consolidated Street Railway Company there has been a contest as to the ownership of the light company. Opposed to the Stone & Webster offer, a committee of the largest stockholders of the company has sent out circulars announcing the formation of a new holding company to secure control of the stock and prevent it from being bought by outsiders. Named with these interests is J. G. White, of the well-known financial and engineering firm of J. G. White & Company, New York. They argue that it is better to keep the company in the possession of the citizens of Worcester. This committee offers $100 cash and two shares of stock in the holding company, par value $100, for each share of the present stock, and guarantees that the new stock will pay a 5 per cent dividend. The capital of the holding company will be $2,000,000. The Worcester company has outstanding $754,800 of capital stock and has no bonds. It has been paying 8 per cent for some years.

PITTSBURGH, McKEESPORT & WESTMORELAND RAILWAY.—A meeting of the stockholders of the Pittsburgh, McKeesport & Westmoreland Street Railway Company has been called for Nov. 22 to vote on a proposition to spend $2,000,000 on extensions and improvements next spring. George D. Cook, of 25 Broad Street, New York, has undertaken to finance this project, and is now offering for sale at 95 and interest $1,000,000 of 5 per cent gold bonds of this company. A representative has been sent abroad who, it is said, has been successful in placing not less than $500,000 of these bonds in Europe. This company now has a line in operation from McKeesport, on the Ohio River, to Irwin, Pa., in the heart of the coal and gas belt. This line is 11 miles long. It also has under construction a line from Donora to Herminie, which will be connected with the line now in operation by the use of a short branch of electric railway already constructed. These new lines run through a very densely populated and very active industrial section.

PACIFIC GAS & ELECTRIC COMPANY.—A recent financial statement of the Pacific Gas & Electric Company of San Francisco, which is a combination of the California Gas & Electric Corporation and the San Francisco Gas & Electric Company, discloses that, based on actual earnings for six months of the year 1909, the company will show a balance applicable to common dividends of approximately $2,249,373, or a percentage of 12.31 on its $18,725,000 of that class of stock. This compares with 6.82 per cent in 1908, 6.32 per cent in 1907, and 2.62 per cent in 1906, the first year after its organization. This company has expended, in the last five years, more than $9,000,000 out of surplus earnings for improvements, betterments and extensions. Independent engineers set the present value of the purely physical property at $90,000,000, an amount $33,000,000 in excess of the entire bonded debt of the company and its subsidiaries.

CHICAGO RAILWAY EARNINGS.—The Chicago Railways and the Chicago City Railway Companies have issued their joint statement for the year ended Jan. 31, 1909, in accordance with the ordinance of the City of Chicago. The combined income accounts of the two companies show gross earnings of $18,823,094, and net earnings of operation of $5,646,928. After deducting the interest on the capital invested the net earnings are $2,844,761. Of this amount the City of Chicago receives $1,564,618, and the balance goes to the stockholders of the company.

NEW YORK TELEPHONE COMPANY.—At a special meeting of the stockholders of the New York & New Jersey Telephone Company, Sept. 22, authorization was given for the sale of the company's property to the New York Telephone Company. This is in accordance with the policy of administrative consolidation recently announced by the American Telephone & Telegraph Company, the holding company of the Bell system. The New York Telephone Company on the same day filed a certificate of capital increase at Albany, raising its capital from $50,000,000 to $100,000,000, and at the same time a certification was filed of the merger of the Central New York Telephone & Telegraph Company with the New York Telephone Company. This is a part of the program of consolidation which will eventually result in every Bell subsidiary in the State being under one management. The entire outstanding issue of the New York Telephone Company's stock is now owned by the American Telephone & Telegraph Company. This, of course, includes the recent acquisition of about $16,500,000, par value, of the stock which was taken over from the Western Union Telegraph Company.

NEW YORK & NEW HAVEN'S NEW STOCK ISSUE.—The stockholders of the New York, New Haven & Hartford Railroad Company have been called to meet Oct. 27 for the purpose of ratifying an issue of $40,000,000 new stock, the proceeds of which will be used partly for retiring $14,000,000 of maturing obligations and partly for betterments. Among the other things for which this new money will be used is the extension of the electrical zones. These are to be extended from Stamford to New Haven, a distance of 39½ miles. The new stock will be offered to shareholders and convertible bondholders at $125 per share, and will be issued as needed during the next two years.

ALBION POWER COMPANY IMPROVEMENTS.—With regard to the purchase of the property of the Albion Power Company by the A. L. Swett Electric Light & Power Company, which was announced in our last issue, A. L. Swett, president of the latter company, says that the Albion property will be put in good condition and operated with energy from the Medina, N. Y., water-power plant. This plant, which belongs to the Swett company, is said to be a model of efficiency. Mr. Swett says that it is expected to develop about 5000 hp and to serve a territory with 30,000 inhabitants.

INDIANA UNION TRACTION COMPANY.—It is understood that the Indiana Union Traction Company, with headquarters at Anderson, Ind., has purchased the new power dam and electric generating plant which is just being completed on White River, near Noblesville. This construction has been done by the Noblesville Hydraulic Company, and it is understood that the traction company intends to use the plant as an auxiliary for its present system, and also to sell and distribute energy.

DIVIDENDS.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable Oct. 15.

Bangor (Me.) Railway & Electric Company, quarterly, 1½ per cent, payable Oct. 1.

Buffalo General Electric Company, quarterly, 1½ per cent, payable Oct. 1.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable Oct. 8.

Consolidated Gas & Electric Company, Baltimore, preferred, semi-annual, 3 per cent, payable Oct. 1.

Detroit Edison Company, quarterly, 1 per cent, payable Oct. 15.

Electric Securities Corporation, preferred, semi-annual, 2½ per cent, payable Nov. 1.

Electric Storage Battery Company, preferred and common, quarterly, ¾ per cent, payable Oct. 1.

Mexican Telegraph Company, quarterly, 2½ per cent, payable Oct. 15.

Michigan Light Company, quarterly, preferred 1½ per cent, common 1 per cent, both payable Oct. 1.

National Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

New England Telephone & Telegraph Company, quarterly, 1½ per cent, payable Oct. 15.

Pope Manufacturing Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

Stark Electric Company, Cleveland, quarterly, ¾ per cent, payable Oct. 1.

Union Railway, Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Aurora, Elgin & Chicago Railroad Company:					
August, 1909	$163,698	$76,448	$87,250	$29,351	$57,899
August, 1908	153,894	71,174	82,720	27,624	55,096
Birmingham (Ala.) Railway, Light & Power Company:					
August, 1909	181,979	100.036	81,943	.....	.....
August, 1908	172,068	105,630	66,438	.....	.....
Central & South American Telegraph Company:					
Quarter ended Sept. 30, 1909	371,000	163,000	208,000	143.565	66,637
Quarter ended Sept. 30, 1908	365,000	165,000	200,000	143,565	60,935
Chicago Railways Company:					
July, 1909	1,077,693	709.967	367,725	510.187	136,426
July, 1908	962,559	614.263	348,295	430,411	147,122
Cumberland Telephone & Telegraph Company:					
August, 1909	522,544	300.979	321,564	41,938	179,625
August, 1908	489,511	287,636	201,875	37,724	164,151
Dallas (Tex.) Electric Corporation:					
July, 1909	103.340	68,107	38,233	25,070	10,162
July, 1908	101,397	71,129	30,267	26,469	3,770
Detroit United Railway Company:					
July, 1909	771,453	466.319	305.134	162 050	155,754
July, 1908	679,447	417,869	261,578	135,978	132,061
Edison Electric Illuminating Company, Brockton, Mass.:					
July, 1909	18,526	11.913	6,612	3,072	3,540
July, 1908	14,603	8,472	6,130	2,435	3,694
Lake Shore Electric Railway Company:					
August, 1909	130,993	55.822	75.171	33.852	41,318
August, 1908	119,674	54,749	64,925	33,749	31,175
Lowell (Mass.) Electric Light Corporation:					
July, 1909	26,227	14.732	11.494	3.554	7,940
July, 1908	25,315	15,116	10,129	3,621	6,577
Milwaukee Electric Railway & Light Company:					
August, 1909	378,256	175.187	203,069	111,230	91,838
August, 1908	343,510	160.888	182,621	101,154	81,467
Minneapolis General Electric Company:					
July, 1909	77,543	37,263	40,279	29,562	10,716
July, 1908	73,889	32,025	41,863	32,400	9,463
Montreal Street Railway Company:					
Eleven months, 1909	3,492,776	2.078.303	1,414.372	418,801	995,576
Eleven months, 1908	3,329,059	1,978,659	1,350,400	423,021	927,379
Northern Ohio Traction & Light Company:					
August, 1909	231,061	115,724	115,337	43.703	71,634
August, 1908	209,741	107,356	102,385	43,381	59.004
Seattle Electric Company:					
July, 1909	502,586	305,027	287,559	95,074	192,484
July, 1908	366,481	209,949	156,531	87,515	69,016
Twin City Rapid Transit Company:					
July, 1909	640,094	277.570	362.523	140.250	222,272
July, 1908	606.373	278,234	328,234	128,361	199,873

GENERAL NEWS

Construction News.

BURDETTE, ARK.—The Three States Lumber Company is installing an electric light plant to furnish electricity for lighting the town, equipment for which has already been purchased. F. G. Proutt, Randolph Building, Memphis, Tenn., is engineer in charge.

CARLISLE, ARK.—Messrs. Allain & Crow are reported to have purchased the electric light plant, owned by J. E. Tunis, of Carlisle. The new owners, it is said, will install new machinery and make other improvements.

WALNUT RIDGE, ARK.—Plans are being made by the Lawrence County Telephone Company to extend its telephone line to Alicia. The company also proposes to make further extensions to Pocahontas and Jonesboro.

GRASS VALLEY, CAL.—It is reported that plans are being considered to equip the property of the Gold Mound, which is under bond to Edward I. Field, of Telluride, Cal., to be operated by electricity and to install a compressor.

LOS ANGELES, CAL.—Work has commenced on the installation of a power plant for the irrigation of the lands on the Armstrong tract in Riverside and San Bernardino Counties. The cost of the plant is estimated at $50,000. George H. Ennis and J. H. Barbour, and F. C. Finkle, consulting engineer, of Los Angeles, Cal., are interested in the enterprise.

OROVILLE, CAL.—Work has been started by the Pacific Telephone & Telegraph Company in rebuilding its Oroville system. The changes will consist largely in rewiring the city with cables, and later in installing an underground cable in the business portion of the city. The cost of the work is estimated at about $11,000.

PLEASANTON, CAL.—The Spring Valley Company is reported to be making arrangements to commence work on the construction of its power plant, on a site located south of Pleasanton.

POINT RICHMOND, CAL.—The Richmond Light & Power Company has arranged to establish a substation at Second Street and Nevin Avenue, moving its present substation from the Standard Oil works. The change in location will be made to meet a demand for electricity on the east side. The station will be of reinforced concrete, to cost from $6,000 to $10,000.

REDDING, CAL.—The Northern California Power Company has made application to the Superior Court asking that the injunction issued Sept. 4 be modified. The injunction, made at the request of eight Shingletown farmers, restrains the company from diverting any water from North Battle Creek. Since the action was begun the Northern California Power Company has bought the water rights of W. H. Donaldson and Robert Madghson, and it now asks to be allowed to take this water from the creek. It holds, also, that by measurement made Sept 4, the creek contains 1725 in. of water and the farmers' ditch carries away only 1400 in., 100 in. of which is wasted. The power company wants permission to pick up all the surplus and waste.

SAN FRANCISCO, CAL.—Information received from Washington, D. C., is to the effect that the E. D. Crowley Company, of this city, has been awarded the contract for constructing a power plant at the Mare Island Navy Yard, at $50,894.

SAN JOSE, CAL.—The Board of Supervisors will receive bids until Oct. 18 for a franchise to build an electric railway along the county highway between Palo Alto and Mayfield, application for which has been made by the Peninsular Railway Company, of San Jose.

SONORA, CAL.—The transfer of the properties of the Toulumne Water Power Company and the Stanislaus Electric Power Company to the Sierra & San Francisco Power Company has been completed in the United States district court. The recent sale of the properties was officially confirmed. The new company is capitalized at $20,000,000. It is said that work on the large storage reservoir at Camp Relief will be pushed as rapidly as possible.

HAVANA, CUBA.—The Cuban Telephone Company has recently been granted permission to extend its telephone lines in all parts of the island. The company is planning to install an automatic system in Havana, and will place its wires underground in this city within a few months.

DELAWARE CITY, DEL.—The City Council has granted the Delaware Water Improvement Company, of New Castle, Del., a franchise to erect a transmission line in Delaware City for the distribution of electricity. It is expected that the city will install electric street lamps. It is paying $800 per year for the lamps now in use.

WILMINGTON, DEL.—The construction of an electric light plant in Gordon Heights, just north of Wilmington, is under consideration, according to a statement made by Ernest B. McNair. The citizens are building a water works system, and it is already proposed to enlarge the plant in connection with the proposed electric light plant, and to operate the pumps by electricity.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 16, for installing two electric passenger elevators at the U. S. Naval Medical Hospital, Washington, D. C., plans and specifications for which can be obtained on application to the above bureau. William M. Smith is acting chief of bureau.

DALLAS, GA.—Arrangements are being made by the Paulding County Power Company to commence work on the construction of its proposed dam across Pumpkinville Creek, about Oct. 1, where it is estimated that about 1,000 hp can be developed.

JEFFERSON, GA.—The Jefferson Cotton Mills Company, of Jefferson, Ga., has entered into a contract with the City Council for the construction of an electric light plant to furnish electricity for lighting the town and for operating the water works pumps. Work on construction of the plan will commence in the near future. E. P. Taylor, of Athens, Ga., is engineer.

MACON, GA.—Application has been made for a charter for the proposed street car line from Tharpe's crossing in East Macon to the grounds of the Recreation Club. The project is capitalized at $150,000, and franchises have been secured. Frederick Kauffman is at the head of the enterprise.

SAVANNAH, GA.—Bids will be received by the Committee on Streets and Lanes until Nov. 8 for furnishing electricity for arc and incandescent lamps for lighting the streets of the city and also for electricity to be used for lamps, heat and power, specifications for which can be secured at the office of Harry Willink, director of Public Works. At present there are about 570 arc lamps in use on the city streets.

WAYCROSS, GA.—At an election to be held Oct. 15 the citizens will vote on the proposition to issue $45,000 for the construction of an electric light plant.

MURRAY, IDAHO.—The construction of an electric light plant in Murray is under consideration. A. H. Featherstone and C. F. O. Merriam, of Wallace, Idaho, are interested in the project.

BURNT PRAIRIE, ILL.—Surveys have been started by the Carmi-Fairfield Traction Company for its proposed electric railway to connect Carmi, Sumpter, Liberty and Fairfield, a distance of about 25 miles. E. S. Lawrence, of St. Louis, Mo., is engineer.

CHICAGO, ILL.—It is reported that plans have been completed by Shepley, Rutan & Coolidge for the construction of a large addition to the power plant of the Commonwealth Edison Company at Quarry Street and the river, at an estimated cost of $1,000,000.

MOLINE, ILL.—The Tri-City & Northeastern Interurban Railway Company of Port Byron has been granted a franchise by the Board of Supervisors to construct an electric railway from Port Byron to Rapids City. The company proposes to build an electric railway from Watertown to Albany. J. W. Simonson, of Port Byron, is president of the company.

STREATOR, ILL.—Improvements are being made to the power house of the Illinois Light & Traction Company, which will include the installation of two 312-hp Heine boilers, stokers, grates and a coaling trestle.

DECATUR, IND.—The directors of the Citizens' Telephone Company have decided to make extensive improvements to the plant.

FORT WAYNE, IND.—The Toledo, & Fort Wayne Electric Railway Company has been granted a franchise to construct an electric railway along the public highways. The proposed railway of the Toledo & Fort Wayne Railway Company will connect with the Toledo & Indiana Railway at Bryan.

GREENE CASTLE, IND.—The work of rebuilding the entire toll line system of the Greene Castle Telephone Company is almost completed. Some new equipment will be installed in the principal exchange.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company is pushing the work of improving and extending its plant, which includes a new exchange building, automatic switchboards, underground and aerial construction, a new automatic substation on the west side entailing an expenditure of $100,000. The company has nearly 15,000 subscribers and is making new contracts at the rate of 450 to 500 per month.

INDIANAPOLIS, IND.—The Board of Control of Public Buildings, consisting of the Governor, Secretary and the Auditor of State, is asking for bids for supplying electricity for lamps and motors at the State House for the ensuing two years. The Governor is now gathering data concerning the cost of erecting and operating a plant to supply light, heat and water to the capitol. If the report of the engineer employed to prepare this data indicates the advisability of erecting such plant the Governor will recommend the same to the next Legislature. The total cost of heat, light, power and water for the State Capitol last year amounted to $17,266.

INDIANAPOLIS, IND.—Bids will be received until Oct. 15 by the Commission of the Indiana State School for the Deaf, Room 54 State House, Indianapolis, Ind., for material and labor to complete and install

the mechanical equipment of the institution located in Indianapolis, Ind., including boilers, stokers, heaters, pumps, generators, switchboards, refrigerating machinery, well, trenches, water lines, pipes and various supplies, etc., according to plans and specifications on file at the office of Rubush & Hunter, architects, American Central Life Building, Indianapolis, Ind. James Bingham is secretary of commission.

MONROE CITY, IND.—The exchange building of the Monroe Telephone Company was entirely destroyed on Sept. 13 by fire, causing a loss of about $18,000. A new building will be erected and modern equipment installed.

NOBLESVILLE, IND.—It is reported here that the Indiana Union Traction Company has purchased and will take over and operate the new power dam and electric generating plant just being completed on White River near this city by the Noblesville Hydraulic Company. It is said to be the purpose of the Traction Company to use the power plant as a feeder for its system and also to sell and distribute electricity to towns and cities.

PAOLI, IND.—The Board of Commissioners of Orange County has granted Charles D. Kelso and J. H. Fawcett a franchise to construct an interurban electric railway over the county turnpike from Paoli to New Albany.

PORTLAND, IND.—The Central Union Telephone Company has sold its exchange and rural lines in this city and Jay County to the Home Telephone Company. An underground system will be installed combining the two plans.

RICHMOND, IND.—The City Council has passed an ordinance providing that it shall be unlawful for water or gas companies to charge patrons rent for meters. Charges of from 50 cents to $1 a month for meter services have been exacted and the ordinance will be resisted in the courts. The city is planning to purchase the waterworks plant, to be operated in conjunction with the municipal lighting plant.

SPICELAND, IND.—The Spiceland Telephone Company has increased its capital stock from $10,000 to $20,000, the proceeds to be used to rebuild the plant and extend its lines.

WARSAW, IND.—The Commercial Telephone Company of Warsaw, Ind., has decided to construct a new No. 10 copper toll line from this city to Wabash, and another toll line from this city to Goshen and Ligoniter.

WINONA LAKE, IND.—Plans are being considered by the Winona Interurban Railway Company for the construction of an extension of its system in Goshen from the station to the hydraulic plan, for which a franchise has already been secured.

DES MOINES, IA.—The Des Moines & Sioux City Railway Company has secured more than 100 miles of right of way for its proposed electric railway, and has also made arrangements for terminals in Sioux City and Des Moines. M. H. Miller is vice-president and general manager.

KEOKUK, IA.—The Mississippi Valley Telephone Company is planning to make improvements to its system which will involve an expenditure of about $10,000.

MUSCATINE, IA.—Orders have been placed by the Citizens' Railway & Light Company for a 750-kw Westinghouse turbine and a 300-kw rotary convertor to be installed in its power house within a few weeks.

OELWEIN, IA.—The Oelwein Light, Heat & Power Company is making extensive improvements to its plant, including the erection of a 100-ft. smoke stack, and the installation of a new engine and generator.

SHEFFIELD, IA.—The property of the Mutual Telephone Company with exchanges at Sheffield, Thornton, Swaledale, Meservey, Latimer, Alexander, Coulter and Chapin, has been sold to G. A. Leonard, of Waterloo, and Daniel Murphy, of Greene, Ia., for about $100,000. It is said that repairs and improvements will be made to the lines at once.

LOUISVILLE, KY.—Plans are being made by the Bradford Worsted Spinning Company to erect a new plant, for which contracts for machinery have been placed. The equipment of the power plant will include four 200-hp return tubular boilers, a 700-hp Hamilton Corliss engine direct connected to generator, and motors.

LOUISVILLE, KY.—The Louisville Railway Company is building an addition to its power plant in Louisville, the cost of which is estimated at about $70,000.

NEWPORT, KY.—The City Council has passed the ordinance authorizing the sale of the telephone franchise in Newport.

CROWLEY, LA.—The power plant of the municipal electric light and water works system was destroyed by fire Sept. 18, causing a loss of about $15,000. At present the streets of the town are in darkness; the dynamo and engine being ruined by the fire. There will be no inconvenience with the water supply, as the pumps of several factories are connected with the stand pipe, which can furnish water to the town.

FRANKLINTON, LA.—The Board of Trustees has granted a franchise to the Cumberland Telephone & Telegraph Company to erect a telephone system in Franklinton.

SHREVEPORT, LA.—The plant and holdings of the Shreveport Telephone Company were sold recently at auction to a committee representing the bondholders. It is said that the sale was brought about for the purpose of getting the affairs of the company in such shape that arrangements could be made for extensive improvements. No change is contemplated in the management and the service is to be extended and improved in the near future.

BELFAST, MAINE.—The Penobscot Bay Electric Company, which has taken over the property and holdings of the Belfast Gas & Electric Company, expects to be able to furnish electricity from its plant in East Orland, within 60 days, when the plant in East Belfast will be closed down, but which will be kept in readiness for use in emergencies. The company will extend its transmission line to the Northport line this fall or early next spring.

BALTIMORE, MD.—It is said that Robert J. McCuen, superintendent of lamps and lighting, is considering the installation of electric lamps in sections now lighted by naphtha lamps, and a recommendation to that effect will be made to the Board of Awards. The Consolidated Gas, Electric Light & Power Company has offered to supply electricity for a term of five years for $27.45 per lamp per year, through overhead wires. For underground service the company's bid was $52.45 per lamp, offering to take off $20 per lamp if allowed to use the present arc cables in providing the incandescent service. In cases where the city owns the fixtures and has its own cables in the conduits the company will furnish the service at $27.45 per lamp. This offer applies to the parks and boulevards.

AMHERST, MASS.—Surveys are being made by the Connecticut River Power Company for the extension of its high-tension transmission line from the power house of the Amherst Gas Company through South Amherst and Hadley across the river near the Ox Box to Easthampton.

ATHOL, MASS.—The Athol Gas & Electric Light Company has applied to the State Gas and Electric Light Commissioners for permission to issue 1748 shares of additional capital stock, par value of $100, the proceeds to be used to pay the cost of additions to its plant. The company also proposes to take over the plant and holdings of the Orange Electric Light Company, including water power and power plant, at a cost of $71,816.

BRIDGEWATER, MASS.—At a special town meeting held Sept. 23 the citizens voted to instruct the committee to enter into a five-year contract with Bridgewater Electric Company for lighting the streets of the town. Under the new contract the present ac lamps will be replaced with 14 incandescent lamps of 60 cp and 172 incandescent lamps of 25 cp.

CLINTON, MASS. The Connecticut River Power & Transmission Company has completed its transmission line to Clinton, and is now furnishing electricity to operate the Lancaster Mills in Clinton, which will require about 2000 hp.

FALL RIVER, MASS.—The Fall River Electric Light Company has submitted a proposition to install boulevard electric lamps of 40 cp for $20 per lamp per year, and 60-cp lamps at $25 each per year, which includes the erection of poles, lamps, fixtures, and entire cost of equipment and maintenance. The city has been paying about $27 each per year for gas lamps for the boulevard.

MARBLEHEAD, MASS.—It is reported that negotiations are under way for the consolidation of the Marblehead Gas & Electric Company and the Lynn Electric Company.

MARLBORO, MASS.—The Marlboro Electric Company has connected its system with the transmission lines of the Connecticut River Power & Transmission Company and electricity for operating the local system is received from the hydroelectric plant at Vernon, Vt. The Florence Street station will be held in readiness for use in case of emergency. C. L. Davis is superintendent.

QUINCY, MASS.—Negotiations have been completed whereby the Quincy Electric Light & Power Company will furnish electricity for lighting the streets of the city for a term of three years, beginning from July 1, 1909. Under the terms of the new agreement the company is to furnish arc lamps at the rate of $70 each per lamp, and incandescent lamps for $15 per lamp per year. Under the old contract the price for arc lamps was $75 each per year, and incandescent lamps $16.50 each per year. Under the new arrangements the city will save about $100 per month in the cost of street lighting.

WESTBORO, MASS.—Negotiations have been closed whereby the Westboro Gas & Electric Company will secure electricity for operating its system from the Connecticut River Power & Transmission Company, through the Marlboro Electric Light Company. Work will soon commence on the construction of the transmission line from Westboro to Northboro, for which a franchise has already been secured from the State Highway Commissioners.

WORCESTER, MASS.—The Worcester Electric Light Company has made a reduction of about 25 per cent in its price for electricity for lamps and motors. The new schedule, which went into effect Sept. 1, is as follows: For the first 150 kw, 6 cents per kw-hour; from 150 to 300 kw, 5.7 cents; from 300 to 400 kw, 5.5 cents; from 400 to 700 kw, 5.2 cents; from 700 to 800 kw, 5 cents; from 800 to 1000 kw, 4.7 cents; from 1000 to 1300 kw, 4.5 cents; from 1300 to 1500 kw, 4.2 cents; from 1500 to 1700 kw, 4 cents; from 1700 to 1900 kw, 3.7 cents; from 1900 to 2500 kw, 3.5 cents; from 2500 to 3500 kw, 3.3 cents; from 3500 to 4500 kw, 3.2 cents; from 4500 to 5500 kw, 3.1 cents; from 5500 to 6500 kw, 3 cents; 6500 to 7500 kw, 2.9 cents; 7500 to 8500 kw, 2.8 cents; 8500 to 9000 kw, 2.7 cents; 9000 to 10,000 kw, 2.6 cents; 10,000 to 12,500 kw, 2.5 cents; 12,500 to 15,000 kw, 2.4 cents; 15,000 to 17,500 kw, 2.3 cents; 17,500 to 20,000 kw, 2.2 cents; 20,000 to 25,000 kw, 2.1 cents, and for 25,000 kw and over, 2 cents.

DETROIT, MICH.—Plans have been prepared by the Detroit United Railway Company for the construction of a new substation at Milwaukee Avenue and Dubois Street, and for placing underground all wires con-

necting the main station with the new one. The cost of the improvements is estimated from $150,000 to $200,000.

GRAND RAPIDS, MICH.—The stockholders of the Citizens' Telephone Company, of Grand Rapids, have voted to increase the capital stock of the company from $3,500,000 to $5,000,000, the proceeds to be used for extensions and improvements to its system.

AURORA, MINN.—Application has been made to the town officials by the Hartley Electric Company, of Virginia, Minn., for a 20-year franchise to construct and operate an electric light plant in Aurora.

BEMIDJI, MINN.—The City Council has refused to grant a renewal of the franchise of the Warfield Electric Company, which will soon expire.

WELLS, MINN.—The contract for a new generator and appurtenances for the municipal electric light plant was awarded to the General Electric Company for $1,275.

WINONA, MINN.—The Winona Railway & Light Company contemplates purchasing boilers and coal handling outfit for its plant. C. A. Bernier is electrical engineer.

LOUISVILLE, MISS.—The Town Council is reported to have granted E. Grover a franchise to erect transmission lines for the distribution of electricity in Louisville.

MOUNT OLIVE, MISS.—Work has commenced on the construction of the municipal electric light plant, machinery for which has already been purchased. The cost of the plant is estimated at about $8,000.

HILLSBORO, MO.—The citizens are considering the question of issuing $15,000 in bonds, the proceeds to be used for the construction of an electric light plant.

KANSAS CITY, MO.—The construction of the proposed electric railway of the Interstate Railway Company from Kansas City to St. Joseph has been placed in charge of the Electric Traction Company, Kansas City, Mo. Bids for the construction of the railway will be opened at once. The cost of the railway is estimated at $2,000,000. N C. Van Natta, Corley Building, St. Joseph, Mo., has charge of the work.

LEE'S SUMMIT, MO.—Marcus A. Bogie, of Kansas City, Mo., is reported to have applied to the City Council for a franchise to construct an electric light plant in Lee's Summit, or to purchase the plant already established.

MARYSVILLE, MO.—We are informed that the contract for installing power plant, heating, ventilating, and plumbing at the Fifth District Normal School, has been awarded to MacMahon & Co., of Kansas City, Mo. A. Rickenrode is secretary of board of regents.

SAVANNAH, MO.—An election will soon be held to vote on the proposition to issue $7,500 in bonds, the proceeds to be used for improvements to the municipal electric light plant. It is said that J. H. Van Brunt, general manager of the St. Joseph Railway, Light, Heat & Power Company, has submitted a proposition to furnish electricity for operating the municipal lighting system, which is considered favorably by the Council, but a special election will be required to approve of the proposed plan. The transmission line will also furnish electricity for the Savannah interurban railway. R. L. Limerick is city clerk.

BEARCREEK, MONT.—The City Council has granted the Bearcreek Water & Electric Light Company a franchise to construct and operate an electric light plant and water works system in the Bearcreek. The company is capitalized at $30,000, and proposes to erect a power plant about a mile above the town. The water will be utilized to generate electricity and for domestic purposes. Chris Yegen, George Lamport, Robert Levens, James Ash and N. S. Poole are interested in the enterprise.

BILLINGS, MONT.—Plans have been completed for the construction of an electric railway between this city and Laurel, work on which will commence within a few weeks. A. H. Bowne is promoter of the railway.

FAIRFIELD, NEB.—The contract for the construction of an electric light plant and water works system has been awarded to F. C. Brooks Sons Company, of Jackson, Mich. W. E. Underkofler is city clerk.

SEARCHLIGHT, NEV.—The Memphis Mining & Milling Company has secured the Weeks ground, near Searchlight, and is installing a power plant, preparatory to sinking its shaft. A. L. Hill is manager.

SWEETWATER, NEV.—The Walker River Electric Power Company is planning to install a large electric plant on the East Walker River, near Sweetwater. The cost of the plant is estimated at about $750,000. George B. Costigan and Dr. A. L. Pollard, of Denver, Col., are interested in the project.

HOBOKEN, N. J.—The Common Council on Sept. 22 passed the ordinance granting the Citizens' Light, Heat & Power Company a franchise to construct and operate an electric light plant in Hoboken. Work will commence on construction of the plant, building of conduits, etc., as soon as possible. The company expects to have its plant in operation and furnish electrical service within two years. It will furnish arc lamps for street lighting at the rate of $70 each per year, and electricity for commercial purposes at a maximum rate of 8 cents per kw-hour. In case the city decides to establish a sewerage pumping plant the company is to furnish electricity for operating the pumps at cost.

IRVINGTON, N. J.—The Town Council has adopted a resolution authorizing the committee to engage an electrical engineer to prepare plans for a municipal electric light plant and invite estimates for cost of the same. The Council also adopted a resolution directing the Fire and Water committees to take under advisement the purchase of the plant of the Clinton Water Company, which now controls the water supply of the town.

MORRISTOWN, N. J.—It is reported that the Morris County Traction Company has secured funds to the amount of $1,000,000, for the construction of its proposed railway. It is said that the company will commence work at once on the construction of its road from Morris Plains to Mount Tabor, connecting there with a direct route to Lake Hopatcong.

ORANGE, N. J.—Only three bids were received Sept. 20 by the Orange Council for the construction of the proposed municipal electric light plant. According to the figures submitted, the work will cost at least $109,500, and $14,500 additional if an underground conduit is laid in Main Street, which is about $50,000 more than the cost estimated when the plant was projected, about two years ago, and bids secured on the plans of James Seymour, Jr. The total cost of the plant was $47,400. Runyon & Carey, who prepared the present plans, state that no comparison should be made between the estimates under consideration and the bids received two years ago, as the former plans were incomplete and would have necessitated large expenditures above the original costs had the contracts been awarded at that time. The bids submitted provide for a plant with sufficient output to supply 500 magnetite arc lamps at a cost of $51.78 each per year, and 95 tungsten lamps at $20 per lamp per year, for which the city now pays the Public Service Corporation at the rate of $85 each for 500 arc lamps and $20 each for tungsten lamps. The bids submitted are as follows: W. M. Sheehan & Company, of New York, N. Y., for general construction and installation, $111,278, and for Main Street conduit $14,500; L. K. Comstock & Company, of New York, N. Y., for general work, $109,500; for Main Street conduit, $14,500; Storms & Company, of Newark, N. J., $111,714; for Main Street conduit, $16,604. The original plans provided for the erection of the plant in connection with the water works system, and provided for only 37 miles of wiring, while the present plans call for 67 miles of wiring.

DEMING, N. M.—It is reported that the Northern Construction Company, of Kansas City, Mo., has submitted a proposition to install an 800-hp electric power plant in Deming, which, it is said, is being favorably considered.

FRENCH, N. M.—A franchise has been granted to the French Town Company to erect poles and wires for the distribution of electricity in the town of French.

ALBANY, N. Y.—The Public Service Commission, Second District, has authorized the Colonie Electric Company, of Colonie, to transfer all its property rights, franchises and privileges, excepting its generating station and equipment, to the Municipal Gas Company of Albany, N. Y. The commission also authorized the Municial Gas Company to construct and operate a distributing system on and along the Troy Road from the Albany city line to the Schuyler Bridge and Van Rensselaer Avenue, Menands Road, Loudonville Road, Lyon Avenue and Ward's Lane in the town of Colonie for the distribution of electricity, in accordance with franchise granted by the Town Board Sept. 4, 1909.

BALDWINSVILLE, N. Y.—Owing to the Village Trustees and the officials of the Seneca River Power Company being unable to come to an agreement in regard to the price for street lamps, the electric street lighting service has been discontinued. The company has offered to furnish 65 arc lamps at $75 each per year, but the trustees are not willing to pay more than $70 per lamp per year. A committee, consisting of Carl Lager, John C. Miller and W. H. Tappin, has been appointed to investigate the matter and report at a later meeting. Many of the taxpayers are in favor of establishing a municipal plant if better terms cannot be made with the local company. The old contract expired last April and has been renewed from month to month in hopes of an agreement being reached. Simon B. Storer, president of the Seneca River Power Company, states that the company would proceed with its plans to erect a new power plant to supply manufacturers and others with electricity for lamps and motors. The company has a perpetual franchise in Baldwinsville.

BUFFALO, N. Y.—The Buffalo Southern Railway Company announces that it will soon commence work on an extension to East Aurora, which it expects to have completed about Jan. 1, 1910. The company has about five miles of the railway in operation and it will require an addition of about eight miles to complete the route.

EDWARDS, N. Y.—Arrangements are being made by U. O. Webb to install an electric light plant in connection with his grist mill. Transmission lines are now being erected for the distribution of electricity. It is expected that the town will enter into a contract with Mr. Webb for lighting the streets. Contracts have already been placed for lighting many of the business places and residences in the village.

NAPLES, N. Y.—A rural telephone company has been organized at Boswell's Corners, in the town of South Bristol, a settlement seven miles northwest of Naples. The officers of the company are: Hiram Reed, president; Frank Greenman, vice-president; Albert Worden, secretary; Henry Loos, treasurer, and Albert Andrews, manager.

NEW YORK, N. Y.—Justice O'Gorman of the supreme court, has authorized George W. Linch, receiver of the Second Avenue Railroad Company, to issue $500,000 in receiver's certificates, bearing 6 per cent interest and maturing in one year. The proceeds will be used to rebuild its car barns, laying new tracks and to utilize the unused tracks in Worth Street between Chatham Square and Broadway as a terminus for the road by replacing the old horse tracks with electrical equipment, the cost of which is estimated at $125,000.

NEW YORK, N. Y.—The New York, Westchester & Boston Railway Company is reported to have purchased all of the right of way for its branch line which it proposes to build to White Plains.

NIAGARA FALLS, N. Y.—The Water Commission has decided to accept the offer of the Niagara Falls Hydraulic Power & Manufacturing Company to purchase the property in the lower milling district on which the present municipal waterworks pumping plant stands for $20,000. In consideration of the sale the company agrees to supply electricity for the new pumping station up to 800 hp for a term of 76 years at $9 per horse-power per year and all above that amount for $10 per horse-power. The Niagara Falls Power Company offered to furnish electrical power for the pumping station at the rate of $20 per horse-power per year.

NIAGARA FALLS, N. Y.—The J. Ellwood Baird Company, of Buffalo, N. Y., was awarded the contract for furnishing 18,600 ft. of four-hole duct for the transmission line cables to the pumping station for $2,976, and the contract for laying the conduit in Ferry Avenue, Portage Road, Welch Avenue, Sugar Street, Buffalo Avenue and Columbus Avenue, for $12,700.

ROCHESTER, N. Y.—Bids will be received by the Board of Education, Municipal Building, Rochester, N. Y., until Oct. 4, for material and labor required for electric wiring and fixtures for Public Schools Nos. 4, 5, 9, 13, 17, 18, 30, 36 and all of the ground floor halls not included in the foregoing, according to plans and specifications of the architect, J. Foster Warner, which may be seen at the office of the board. J. S. Mullan is secretary.

WILLARD, N. Y.—Sealed proposals will be received by the State Commission in Lunacy, State House, Albany, N. Y., until Oct. 6, for furnishing and installing one direct-connected engine and 75-kw, direct-current dynamo at the Willard State Hospital, Willard, N. Y. Plans and specifications may be seen and blank forms of proposals secured at the Willard State Hospital, Willard, N. Y., or at the office of the state architect, Albany, N. Y. Complete set of plans will be furnished upon application to F. B. Ware, state architect.

TOWNER, N. D.—The Board of County Commissioners has granted a franchise to the Turner Telephone Company to erect telephones over the county roads.

COLUMBUS, OHIO.—The Board of Managers of the penitentiary has revoked its action in granting the contract for the construction of the power house to John Hina, of Columbus, Ohio, and has ordered the work readvertised. The contract will be awarded at a special meeting to be held in October.

DAYTON, OHIO.—The Dayton Street Railway Company has increased its capital stock to $300,000. The proceeds of the sale will be used to construct the proposed extension between Athletic Park and Carrmont. W. L. Smith is general manager.

DENNISON, OHIO.—The United Electric Company expects to purchase a 150-kw, direct-current generator for railway service within a few weeks. The company has closed a contract with the C. & G. Cooper & Company for a 400-hp Corliss engine, heavy duty type.

LOGAN, OHIO.—Arrangements are being made by the Logan Home Telephone Company for extensive improvements to its system, which will involve an expenditure of about $10,000. The common battery system will be installed. A contract has been awarded to the Kellogg Switch-Board & Supply Company, of Chicago, Ill.

YOUNGSTOWN, OHIO.—Contracts have been placed by the Mahoning & Shenango Railway & Light Company for one 600-kw motor-generator set with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., and one 200-kw motor-generator set with the General Electric Company, of Schenectady, N. Y. It is stated that two additional boilers will be installed in the North Avenue power station about Nov. 1, which will increase the output of plant by about 1000 hp.

OKLAHOMA, OKLA.—The County Commissioners have granted Homer S. Hurst, of Holdenville; Alfred Hare, of Shawnee; W. F. Harn and J. F. Winans a franchise to construct an electric railway over certain highways in Oklahoma County.

ALBANY, ORE.—A deed and mortgage have been filed with the county recorder of Linn County, which practically transfers all of the property of the Willamette Valley Company to the Northwestern Gas & Electric Company, and the latter company has issued a mortgage for $5,000,000 in favor of the Germantown Trust Company, of Philadelphia, Pa., to secure an issue of $5,000,000 in bonds, the proceeds to be used in the development of the properties acquired and for extensions which may be necessary. The property covered by the mortgage includes the street railway system of Walla Walla, the interurban railway from Walla Walla to Milton and Freewater, the power ditches, water rights and power plant in Umatilla County, for transmission of electricity to Walla Walla and Pendleton; the water system, electric light plant and power plant in Albany; the electric system in Corvallis; the power plant, water system, electric system and gas plant in Eugene; the electric plant in Dallas and Monmouth; the water system and electric light plant in Independence; the gas plants at North Yakima, Wash., and Lewiston, Idaho. The officers of the company are: Isaac W. Anderson, of Philadelphia, Pa., president; Clyde W. Hellar, of Philadelphia, Pa., secretary, and Alvadore Welch, of Portland, Ore., treasurer and general manager.

DAYTON, ORE.—The Yamhill Electric Company, of Newberg, Ore., which was recently granted a franchise in Dayton, will extend its transmission line to this town and install a distributing system, at a cost of between $5,000 and $6,000. C. J. Edwards, of Newberg, is general manager.

EUGENE, ORE.—The contract for the erection of the transmission line for the municipal power plant was awarded to J. B. Morris, of Eugene, Ore., for $3,642. The line will be about 15 miles in length.

PORTLAND, ORE.—Arrangements have been made by the Seventh Street Improvement Association for the installation of 100 ornamental lamp posts on Seventh Street, from Couch to Columbia Street, at a cost of about $10,000.

PORTLAND, ORE.—W. W. Purdy, chief engineer of the Oakland & Tidewater Railway Company, is reported to have completed a survey from Oakland across the mountains to Coos River and down to Marshfield, for the proposed railway of the company, which is to extend from Oakland to Empire. C. A. Pengra and H. D. May, of Portland, Ore., are interested in the project.

WESTON, ORE.—Plans are being drawn by J. M. Ashworth, of Weston, for a large irrigation system. The project includes the installation of an electric power plant and the irrigation of 12,000 acres of land tributary to Weston. It is proposed to erect a dam 200 ft. high, creating a large storage reservoir. The cost of the plant complete is estimated at $250,000.

HARRISBURG, PA.—The Merchants Telephone & Telegraph Company has filed amendments to its charter increasing its capital stock from $100,000 to $400,000.

HAZLETON, PA.—The Wilkes-Barre & Hazleton Railway Company has placed contracts for the following apparatus: Three 150-kw, single-phase, 16,000-183 step-down transformers; one 400-kw converter; two 350-hp boilers, and three 375-kw, single-phase, 390-16,000 step-up transformers.

McKEESPORT, PA.—A meeting of the stockholders of the Pittsburgh, McKeesport & Westmoreland Street Railway Company has been called for Nov. 22 to vote on the proposition to spend $2,000,000 on extensions and improvements next spring. It is understood that provision has been made for obtaining money, and it will be available as soon as the stockholders approve the proposed plan.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 16, for alteration in power plant at the Naval Home, Philadelphia, Pa., plans and specifications for which can be obtained on application to the above-named bureau or to the commandant of the navy yard, Philadelphia, Pa. William M. Smith is acting chief of bureau.

ROARING CREEK, PA.—The capital stock of the Roaring Creek Valley Telephone Company has been increased from $5,000 to $10,000.

DILLON, S. C.—It is reported that the municipal electric light plant has been purchased by Wade Stackhouse. Mr. Stackhouse would like to receive estimates on the cost of the installation of a three-phase, alternating-current plant, or improvements to the present direct-current plant, which includes about 10 arc lamps and 1,000 incandescent lamps of 16 cp.

ORANGEBURG, S. C.—Investigations are being made by the Edisto Power Company for the construction of its proposed hydroelectric plant on the Edisto River, where it is estimated that from 5,000 to 10,000 hp can be developed for electrical transmission. For further information address Wolfe & Berry, of Orangeburg, S. C.

RAMONA, S. D.—We are informed that plans are being considered for the construction of a municipal electric light plant in Ramona. J. S. Stevens is town clerk.

TYNDALL, S. D.—We are informeed that the City of Tyndall is contemplating the installation of a municipal electric light plant to cost from $10,000 to $12,000 It is proposed to install an alternating-current system and a Fairbanks gas producer.

BROWNSVILLE, TENN.—The Brownsville Cotton Oil & Ice Company, which recently purchased the plant of the Brownsville Light & Power Company, is making improvements to the plant, including the installation of a 300-kw, three-phase 2300-volt, direct-connected equipment, machinery for which has already been purchased. The company is also arranging to operate two cotton gins by electricity instead of steam power. F. G. Proutt, Randolph Building, Memphis, Tenn., is engineer in charge.

ERWIN, TENN.—Arrangements are being made by the Unaka Traction Company for the construction of its proposed power plant. I. R. Roberts is general manager.

BEEVILLE, TEX.—The citizens are considering the question of issuing bonds for the construction of an electric light plant and waterworks system.

MARLIN, TEX.—The plant of the Marlin Electric Light & Power Company was destroyed by fire Sept. 17, causing a loss of about $60,000.

OGDEN, UTAH.—The Telluride Power Transmission Company has completed the construction of its steel tower line between the North Ogden Canyon and Salt Lake City; the pole line toward Logan has been extended from Ogden as far as Eden, in the upper Ogden Valley. Work will now commence on the erection of the wooden tower line between Ogden and Salt Lake City, which, when completed, will give the company two transmission lines from North Ogden Canyon to Salt Lake City.

PARK CITY, UTAH.—The Daily-Judge Mining Company, of this city, has decided to increase its compressor capacity and to operate its compressors by electricity instead of steam power.

PROVO, UTAH.—The Snake Creek Power Company, of Provo, Utah, has applied to the State engineer for the use of 24 cu. ft. per second of water in Snake Creek, a tributary of the Jordan River, to be utilized to generate electricity. The length of the diverting canal will be 15,000 ft. The plant will operate under a head of 720 ft. The company proposes to distribute electricity for lamps and motors in the cities, towns and mining camps of Wasatch County.

SILVER LAKE, UTAH,—J. A. Kusk, of Silver Lake, Utah, has applied for two water rights in Big Cottonwood Creek to be utilized to generate electricity. One application is for 12 cu. ft. per second and the other for 22 cu. ft. per second, the diverting canals to be 900 ft. and 700 ft. respectively.

BEDFORD CITY, VA.—The City Council has voted to subscribe to 326 shares of capital stock of a company to be organized by citizens of Bedford City, to develop a hydroelectric power plant, subject to a vote of the citizens, in accordance with the plan outlined in a resolution passed by the City Council Oct. 26, 1908. It is proposed to utilize the water power of the James River at Snowden, where a dam was constructed eight years ago, which, it is estimated, is capable of developing 1200 hp.

EMPORIA, VA.—O. L. Housel, manager of the Emporia Electric Power Company, writes that work is progressing rapidly on the construction of its dam, located one mile west of the town. Work has commenced on the erection of the distributing system, and the company expects to be ready to furnish electrical service in the early part of December, when it will take over the business of the Emporia Light & Power Corporation and establish a 24-hour service.

MARTINSVILLE, VA.—At an election to be held Oct. 2 the proposition to issue $35,000 in bonds, the proceeds to be used to enlarge the municipal electric light plant, will be submitted to the voters.

RICHMOND, VA.—Preparations are being made by several of the Virginia railroads, including the Southern Railway Company, the Seaboard Air Line, the Chesapeake & Ohio Railroad, the Atlantic Coast Line Railroad, and the Richmond, Fredericksburg & Potomac Railroad Company, to install telephones to replace the telegraph in dispatching trains. It is said that the Atlantic Coast Line will erect its first telephone line between Richmond, Va., and Rocky Mount, N. C.; the Richmond, Fredericksburg & Potomac Railway contemplates the installation of a telephone system between Richmond, Va., and Washington, D. C.; the Seaboard Air Line will establish a route between Raleigh and Munroe, N. C., and the Chesapeake & Ohio will establish a telephone service between Russell, Ky., and Cincinnati, Ohio.

ABERDEEN, WASH.—The Anderson & Middleton Lumber Company is planning to change its mill from steam to electric drive.

BELLINGHAM, WASH.—Plans are being considered by the Whatcom County Railway & Light Company for extensive improvements and extensions to its York Street station, which will double the output of the plant. The present output of the plant is 2000 hp. It is proposed to close down the Eureka power house when the improvements on the York Street station are completed. The cost of the work is estimated at about $140,000. A new water wheel will be installed immediately in the Nooksack power plant to replace the wheel now in use, at a cost of $35,000. L. H. Bean is local manager.

BLAINE, WASH.—The city is reported to have placed an order with the Sumner Iron Works, of Everett, Wash., for a boiler, engine and heater, to cost $3,500.

CHELAN FALLS, WASH.—It is stated that instructions have been given by the Great Northern Railroad Company to commence work on the construction of its proposed power plant at Chelan Falls, Wash., which, it is understood, will furnish electricity to operate the Great Northern Railway between Brewster and Oroville. It is estimated that 30,000 hp can be developed.

NORTH YAKIMA, WASH.—Notice has been received at the local land office that all power sites along the Yaki, a river in the vicinity of North Yakima, have been withdrawn from entry for the present.

SEATTLE, WASH.—The Board of Public Works has awarded the contract for furnishing the city with electric incandescent lamps to the Forbes Electrical Supply Company for the ensuing year. The contract, it is estimated, will amount to about $40,000.

SPOKANE, WASH.—Bids will be received by the Board of Public Works until Oct. 8, for three 5,000,000-gal. centrifugal pumps; one 650-hp horizontal water wheel; three induction motors, switch-board and connections.

WASHTUCNA, WASH.—The City Council has accepted the proposition of Mr. Gildersleeve to install an electric lighting system, to cost from $5,000 to $6,000. He proposes to furnish seven arc lamps of 2000 cp for lighting the streets, and to furnish electricity for lighting the town hall and hose house for $624 per year, under a five-year contract.

CLARKSBURG, W. VA.—The Consolidated Telephone Company has applied for a franchise to erect a telephone system in Clarksburg.

DODGEVILLE, WIS.—Many of the mines in the southwestern Wisconsin mining regions are equipping their plants to be operated by electricity. The Southwestern Electric Power & Light Company is furnishing electrical power for the mills and the Kennedy mines at Hazel Green. The transmission lines are being extended from Boston to Shullsburg. The Rodhams' new mill and mine are being equipped for electric drive. The Dark Horse and the Rajah mines at Linden are planning to secure electricity to operate the machinery at the mines from the plant at Mineral Point, which is now extending its transmission line into Linden, by the way of the Ridge Road.

INDEPENDENCE, WIS.—The power house of the municipal electric light plant is being enlarged. The old boiler will be reset to make room for a new boiler and a new smokestack erected. The Winona Boiler Company has the contract for the work.

NEW LONDON, WIS.—The Wausau Telephone Company contemplates the erection of a new exchange building in New London, to cost about $25,000.

PORTAGE, WIS.—Work has commenced on the construction of the substation of the Southern Wisconsin Power Company. The building will be 85 x 35 ft. and two stories high.

SCHLESINGERVILLE, WIS.—The Washington County Telephone Company has purchased the plant and holdings of the Cedar Lake Telephone Company for $15,000. The capital stock of the Washington County Telephone Company has been increased from $5,000 to $25,000.

LACOMBE, ALTA., CAN.—The ratepayers have voted in favor of purchasing the plant of the Blindman River Power Company, which supplies this town with electricity for light and power, for $25,000.

ARMSTRONG, B. C., CAN.—It is reported that plans are being considered for improvements to the light and water plants, which will involve an expenditure of about $10,000.

KAMLOOPS, B. C., CAN.—It is reported that a local development company, headed by Walter U. Homfray, has secured water rights on Louis Creek and proposes to organize a company to be known as the North Thompson Power & Development Company.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company has made an application for 30,000 miners' in. of water from Indian River and proposes to construct an auxiliary plant there. R. H. Sperling is general manager.

HAMIOTA, MAN., CAN.—The plant of the Hamiota Power & Electric Light Company has reached the stage where the company is able to supply electricity for 14 street lamps for the town.

WINNIPEG, MAN., CAN.—The Manitoba Government Telephone Commission will at once proceed with the erection of a branch exchange in the western portion of Winnipeg, plans for which were prepared by A. S. Hooper.

WINNIPEG, MAN., CAN.—J. J. & J. M. Kelly, of Winnipeg, have been awarded the contract for construction of the new branch telephone exchange, for $43,000. The Northern Electric Company will install the switchboard for $150,000. F. S. Patterson is chairman of telephone commission.

FORT WILLIAM, ONT., CAN.—The Kaministiquia Power Company is increasing the output of its power plant from 14,000 to 21,000 hp. H. S. Holt, of Montreal, Que., is president of the company.

GALT, ONT., CAN.—The Galt Gas Light Company has submitted a proposition to the Town Council offering to sell its electric light plant to the town for $67,000, which does not include the water-power at the dam. The Council has engaged E. B. Merrill, civil engineer, to make investigations in regard to the value of the plant.

HAILEYBURY, ONT., CAN.—The power plant of the High Falls Power Company, at High Falls, on Wabi Creek, has been put into operation. The plant will supply electricity to the mines in this vicinity. Harlan Brown is manager.

PORT ARTHUR, ONT., CAN.—The city has commenced to lay its telephone wires underground with the intention of placing all overhead wires in conduits.

PORT ARTHUR, ONT., CAN.—The City of Port Arthur has received an offer from the Ontario Hydro Electric Commission to supply electricity in Port Arthur. The Council has been considering a proposition made by James Conmee to supply electricity and was on the point of accepting it, but under the circumstances no agreement will be signed until the offer of the commission has been received. For further information address City Solicitor Keefer.

ST. CATHARINES, ONT., CAN.—Plans are being made by the Niagara, St. Catherines & Toronto Railway Company to construct a rotary transformer station with an output of 500 kw.

TORONTO, ONT., CAN.—The contract for the conduit work in connection with the city's transmission system has been awarded to Golden & Lansing, of Troy, N. Y., for $65,800.

TORONTO, ONT., CAN.—The McGuigan Construction Company is making rapid progress on the erection of transmission lines for the Ontario Government. So far over one hundred towers have been erected and they are being placed in position at the rate of eight per day. When completed the system will carry 110,000 volts and will be the longest transmission line in the world.

WELLAND, ONT., CAN.—The Commissioners of Queen Victoria Niagara Falls Park have granted the Ontario Power Company permission to lay another pipe through the park from the gatehouse to its power house, at a cost of about $1,000,000.

FARNHAM, QUE., CAN.—The by-law authorizing the construction of a municipal electric lighting plant was not voted on, as G. Poulin, who owns the local electric power plant, has reduced his offer from $14,000 to $8,500, and the town will probably purchase the plant at the last named figure.

VERDUN, QUE., CAN.—The municipality has retained Charles Brandeis, consulting engineer, of Montreal, Que., in connection with the proposed extensions to the municipal electric light plant.

WEYBURN, SASK., CAN.—The Weyburn Electric Company has offered to sell its plant to this town for $28,000. The Council is now considering the offer.

New Industrial Companies.

THE AMERICAN POWER & LIGHT COMPANY, of Augusta, Me., has filed articles of incorporation with a capital stock of $15,000,000. The company proposes to manufacture machinery and electrical apparatus. The incorporators are: Harry M. Durning, George J. Anderson, H. B. Squiers and E. W. Hammonds, all of New York, N. Y.

THE AMERICAN UNDERCURRENT COMPANY, of Pittsburgh, Pa., has been chartered with a capital stock of $250,000 by O. E. Longdorf, Paul I. Gundley and M. J. Dain, all of Pittsburgh, Pa. The company proposes to manufacture a new underground trolley apparatus, recently patented by Mr. Longdorf.

THE AUTO & AERONAUTIC SUPPLY COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $20,000 for the purpose of manufacturing and selling automobiles and flying machines. The directors are: Percy A. Larter, Glenn Ethridge, of New York, N. Y., and H. Chandler, of Westbury, N. Y.

THE ELECTRIC CLEANING COMPANY, of Fayetteville, N. C., has filed articles of incorporation with a capital stock of $25,000 for the purpose of operating electrically-driven renovating machines, etc. F. H. Bradley and associates are incorporators.

THE ELECTRIC SUPPLY COMPANY, of Richmond, Va., has been chartered with a capital stock of $5,000 and the following named officers: F. J. Whybrew, president; H. T. Walker, vice-president, and R. A. Burnett, secretary and treasurer. The company proposes to install power plants, motors, and deal in electrical supplies.

THE GENERAL SPECIAL ELECTRICAL COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $100,000 by O. A. Hansen and F. T. Broiles.

THE INVISIBLE LAMP & GLASS LETTER SIGN COMPANY, of Seattle, Wash., has been chartered with a capital stock of $50,000 by O. H. Frederickson and others.

THE KEISEL TELEPHONE & ELECTRIC SUPPLY COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $9,000 by Henry Kuhlmann, Fred Gent and L. Rompel, of St. Louis, Mo. The company proposes to do a general electric business.

THE LONG BEACH ELECTRICAL MANUFACTURING COMPANY, of Long Beach, Cal., has been incorporated by T. J. Corbrey, W. H. Tidmarsh, S. F. Estell, J. Gleason and G. Gleason. The company is capitalized at $25,000, and proposes to manufacture gas and electric fixtures.

THE MAYER-SLOTKING MANUFACTURING COMPANY, of New York, N. Y., has been granted a charter to manufacture cars, carriages, boats, motors, engines, machinery, etc. The company is capitalized at $50,000, and the incorporators are: Samuel Slotkin, Samuel Goldstein, Jacob Burnstone, all of New York, N. Y.

NATIONAL SAFETY APPLIANCE COMPANY, of New Orleans, La., has been incorporated with a capital stock of $300,000 by John Day Nix, L. M. Dalfarn and S. Wexler. The company proposes to manufacture the John Day Nix block signaling and stop system.

THE NEWSTETTER ELECTRIC SYSTEM COMPANY, of Dover, Del., has been incorporated with a capital stock of $3,000,000 by M. A. Noble, T. C. Corwin, of New York, N. Y., and J. Ebbs, of Englewood Cliffs, N. J.

THE PACIFIC BATTERY & ELECTRIC NOVELTY MANUFACTURING COMPANY, of Seattle, Wash., has been incorporated with a capital stock of $100,000 by E. Earl Jaeger and Charles Heinze.

THE SERVICE STANDARD COMPANY, of New York, N. Y., has been chartered with a capital stock of $30,000 to deal in lighting, heating, coaling, cooking and ventilating apparatus. The incorporators are: W. T. Smith, of Rockaway, N. Y.; H. R. Weller, of Roseville, N. J.; A. Bykeefer, of Brooklyn, N. Y., and J. C. Francis, of Yonkers, N. Y.

New Incorporations.

ST. LOUIS, MO.—The Home Co-operative Telephone Company has been chartered with a capital stock of $2,000 by John R. Gay, Truman B. Barnes, Le Roy Gay, J. W. McCormick, all of Maplewood, Mo., and T. A. O'Connor, of St. Louis, Mo.

ST. LOUIS, MO.—Articles of incorporation have been filed for the St. Louis County Belt Railroad Company by James D. Houseman, of Clayton, Mo.; Thomas M. Gallagher, of Webster Groves, Mo.; James E. Hereford, of Ferguson, Mo.; Edward W. Rannells, of Maplewood, Mo.; George B. Bowles, of Afton, Mo.; Charles A. Autenreith, of Clayton, Mo., and Albert Wehmeyer. The company proposes to construct an electric belt railway through St. Louis County from north to south, and circling St. Louis. The railway will be 30 miles in length, extending from Jefferson Barracks on the south to O'Neil on the north. The cost of the railway is estimated at $2,000,000.

BELLEFONTE, PA.—The Center County Traction Company has applied for a charter to construct a street railway from Bellefonte to State College by W. C. Hagan, William H. Furey and L. T. Munson.

FORT WORTH, TEX.—The Fort Worth, Mineral Wells & Western Railroad Company has been incorporated, with a capital stock of $100,000, to construct an electric railway from Fort Worth to Mineral Wells, via Weatherford, a distance of 54 miles, and later to Roswell, N. M. The incorporators are: L. C. Cole, of Fort Worth; N. M. James, and J. S. Hanford, of Beaumont, Tex.

HAMLIN, TEX.—The Hamlin Electric Light & Power Company has been chartered with a capital stock of $15,000 by C. Thompson, G. F. Spurling and Walter E. Morris.

WELLINGTON, TEX.—Articles of incorporation have been filed for the Wellington Water, Light & Ice Company by T. S. Atkinson and others.

SALT LAKE CITY, UTAH.—The Thor Power Company has been incorporated, with a capital stock of $500,000. The company proposes to erect power plants in Salina and Six-Mile Canyons, and will erect transmission lines to supply electricity in Manti, Richfield and other southern Utah towns. A. G. Burritt is president and Mark Anderson secretary, both of Salt Lake City.

VANCOUVER, WASH.—Articles of incorporation have been filed for the Tuni Tum Mountain Railway Company by A. Aronston, H. J. Hener, and others. The company proposes to construct an electric railway to connect Chelatchie, Prairie, Amboy, View, La Center and Ridgefield, a distance of about 40 miles.

CIRTSVILLE, W. VA.—Articles of incorporation have been filed for the Pocahontas Connecting Railway Company by John C. Reading, Robert F. Allen, of Williamsport, Pa.; O. P. Fitzgerald, V. L. Black and G. S. Couch, Jr., of Charleston, W. Va. The company is capitalized at $200,000, and proposes to construct a railway between Girtsville and Jarrold's Valley, a distance of 20 miles.

POINT PLEASANT, W. VA.—The Old Town Mutual Telephone Company has been incorporated, with a capital stock of $5,000, by John R. Stewart and John Clendenin, of Point Pleasant, and others. The company proposes to construct and operate a telephone system in Mason and other counties.

WHEELING, W. VA.—The Dunkard Valley Railroad Company has filed articles of incorporation both in West Virginia and Pennsylvania. The company proposes to build electric railways from Waynesburg to Washington, Pa., and from Mannington to Blacksville, W. Va., thence to Waynesburg, Pa. John L. Johnson, of Wheeling, W. Va., is said to be interested in the project.

KAMLOOPS, B. C., CAN.—The North Thompson Electric Power Company has been incorporated to develop power on Louis Creek. The head office is in Kamloops, and the capital stock of the company is placed at $25,000.

Personal.

MR. THEO. N. VAIL is the subject of an appreciative biographical notice by Mr. James B. Morrow in the Indianapolis *Star* of Sept. 12.

MR. M. V. WATSON, formerly assistant electrical engineer of the Central Colorado Power Company, has been appointed general manager of the Arizona Power Company, at Prescott, Ariz.

MR. JAMES B. YEAKLE, superintendent of the Fire Alarm Telegraph Department of Baltimore, Md., has been re-elected president of the International Association of Municipal Electricians.

MR. JAMES WHALEY, superintendent of the electrical zone of the New York Central Railroad, will succeed Mr. W. G. Bierd as general superintendent of the New York, New Haven & Hartford Railroad about Oct. 1.

MR. ED. HERD has resigned as manager of the Morgantown & Southern Railway, Morgantown, W. Va., to join, as secretary and manager, The Herd Plumbing Company, of Morgantown, which will extend its business to the electrical field.

MR. W. A. O'MEARA, general constructing engineer of the British Telegraph and Telephone Service, is on a three months' visit to this country, during which he will examine into our telegraph systems and inspect the telephone plants of some of the larger cities.

MR. L. D. ROWELL, who has for several years had charge of the experimental and development work of the Cutler-Hammer Manufacturing Company at its Milwaukee works, has resigned that position to accept an offer from the Case School of Applied Science.

MR. WILLIAM MARCONI passed through New York City last week, en route from England to Glace Bay, where he is renewing the wireless power plant recently destroyed by fire, and is putting in an equipment of much larger capacity for work across the Atlantic.

PROF. GUSTAVE F. WITTIG, of the electrical engineering department of the University of Maine, has resigned to become head of the electrical engineering department of the University of Alabama. Prof Wittig was graduated from Columbia University three years ago, and immediately after went to the University of Maine.

MESSRS. FREDK. MOLLENDORF and Oskar Kahle, who are prom-

inently connected with the Siemens-Halske interests at Berlin, Germany, are visiting this country, and are very much interested in its electrical development. While here they will take an opportunity to inspect the latest improvements in street lighting, particularly that done with arc lamps.

MR. W. H. VAN LEEUWEN is here with his father, the Mayor of Amsterdam, Holland, both being members of the Dutch delegation in attendence at the Hudson-Fulton celebration. Mr. Van Leeuwen is greatly interested in mechanical matters, and has visited several plants in the city, including those of the New York Edison Company and the *Electrical World*.

MR. F. H. BANBURY, engineer of the Acheson Oildag Company, of Niagara Falls, sailed for Europe on the steamship *St. Louis*, Saturday, Sept. 25. Mr. Banbury, who has the degrees of electrical, mining and mechanical engineer, is an Englishman by birth, and upon his arrival in America about five years ago became connected with the Commonwealth Edison Company, of Chicago. Somewhat over a year ago he became connected with the Oildag Company, and his trip to Europe is in the patent interests of that company.

VICE-PRESIDENT MATTHEW C. BRUSH, of the Boston Suburban Electric Companies, who leaves this week for Buffalo to take charge of the Buffalo & Lake Erie Traction Company as general manager, was wiven a complimentary dinner at the Algonquin Club on Sept. 21 in Boston by 65 prominent street railway men of New England and New York. The speakers were Hon. S. L. Powers, Boston, toastmaster; Mr. J. C. Calisch, Buffalo; Mayor George Hutchinson, Newton; Alderman Palmer, Newton; Mr. Sidney Harwood, Newton; Mr. C. Loomis Allen, Syracuse, N. Y., and Mr. Russell A. Sears, Boston, who presented the guest of honor with a solitaire diamond ring on behalf of his assembled friends.

MR. W. E. WICKENDEN has been appointed Assistant Professor of Electrical Engineering to assume the duties vacated by Prof. George C. Shaad, who has gone to the University of Kansas to take charge of its electrical-engineering department. Mr. Wickenden was graduated from Dennison University after following a course strong in mathematics and physics. He then taught a year in Rochester, New York, and followed that by a year of graduate study of physics at the University of Wisconsin. He is now in the electrical-engineering staff of the University of Wisconsin, where he has made a record both in teaching and in research work. Professor Wickenden is author of a book, now on the press, on "Photometry and Illumination."

PROF. J. W. ESTERLINE, president and manager of the Esterline Company, Lafayette, Ind., until recently known as the Central Laboratory Supply Company, will hereafter devote the major part of his time to the work of his company, but will continue to give a course of lectures at Purdue University on the design of electrical machinery. The change in name of the company has been due to the growing amount of consulting engineering business which has been coming to Prof. Esterline. Mr. Esterline was born at Fort Wayne, Ind., and received his early training there. He prepared for university work at Fort Wayne College, and entered the Purdue School of Electrical Engineering in 1893, completing the work in 1897. From 1898 to 1907, Mr. Esterline was successively instructor, assistant professor and associate professor of electrical engineering at Purdue, and in 1905 and 1906, during the illness and absence of the late Dr. C. P. Matthews, he was in charge of the work of the department. Mr. Esterline is a member of the American Institute of Engineers, the Society for the Promotion of Engineering Education and the American Society for Testing Materials. For several years he has served as chairman of the committee of the latter society on the magnetic properties of iron and steel. Mr. Esterline has been a frequent contributor to the proceedings of engineering societies and the technical press, and is the author of several works on engineering and electrical design.

PROF. J. W. ESTERLINE

Obituary.

MR. M. G. KELLOGG.—As we go to press word comes from Chicago that Mr. Milo G. Kellogg, founder and president of the Kellogg Switchboard & Supply Company, Chicago, died Sunday, Sept. 26. The funeral took place Sept. 28. Mr. Kellogg was born at Rowman, N. Y., in 1849. A biographical notice will appear in our issue of next week.

MR. LAWRENCE GUSTAV GOETZ, of 207 East Fifty-fifth Street, New York City, was accidentally killed through coming in contact with a 2300-volt circuit in the Bronx Station of the New York Edison Company, Rider Avenue and 140th Street, on Thursday, Sept. 23. At the time of the accident Mr. Goetz was engaged, together with two other men, in setting up recording instruments on the wall in the rear of the arc light switchboard, a space accessible only to the station operatives. He was not working with live wires, nor, in fact, with any part of a circuit. There is a space of over 5 ft. between the back of the board and the wall, and a heavy rubber mat was on the floor upon which Mr. Goetz was standing at the time of the accident. The men were fully aware that the board was alive and that contact with any part of the circuit would be fatal. In fact, Mr. Goetz only a few minutes before the accident had warned his colleagues to be aware of the live circuits. From all that can be gathered it seems that in a moment of possible absent-mindedness he stepped backward and in such an unfortunate way that the calves of his legs came in contact with two projecting fuse receptacles from the 2300-volt lines, completing the circuit through his body, forming an arc which set his clothing on fire. His fellow worker, Kingsley Martin, tried to rescue him and rolled the victim in a heavy blanket to extinguish the flames. He remained conscious and was quickly removed to the Lebanon Hospital where it was found that practically his entire body had been charred; he died two hours after reaching the hospital from the effects of the burns. Mr. Goetz was a student in the Junior Class of Stevens Institute of Technology, and had been prepared for Stevens in the College of the City of New York. He had taken a position in the Test Department of the New York Edison Company for the summer in order to obtain practical experience, and expected to go back to college on the day following the accident. Mr. Goetz was 25 years of age, and was a student ranking high in scholarship. He leaves both parents and a brother and sister.

Business Notes.

THE G. & W. ELECTRIC SPECIALTY COMPANY has changed its address from 128 West Jackson Boulevard to 627 West Jackson Boulevard, Chicago.

THE HERD PLUMBING COMPANY, Morgantown, W. Va., will add a complete line of electrical supplies to its stock and enter the electrical contracting and supply field. Mr. Ed. Herd has resigned as manager of Morgantown & Southern Railway Company, to take charge of the electrical part of the business.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, of Plainville, Conn., manufacturer of electrical supplies, is increasing its plant by the erection of a brick building, 50 x 50 ft., four stories, to be used for manufacturing and storage purposes. The building will be completed this fall.

THE AJAX LINE MATERIAL WORKS have moved their factory into much larger quarters at South Milwaukee, Wis., where their outdoor lighting specialties will be made hereafter. The management remains with Mr. Albert Scheible, who will divide his time between South Milwaukee and a new Chicago office at 525 Van Buren Street.

R. P. WEIFORD & BRO. have organized to conduct business as electrical and illuminating engineers, contractors, manufacturers' agents and supply dealers, at Huntington, W. Va. Mr. R. P. Weiford was connected for several years with the Westinghouse Electric & Manufacturing Company, and is a member of the New York section of the Illuminating Engineering Society.

MESSRS. EDWIN B. PIKE AND ARTHUR B. LEBENBAUM, San Francisco, have sold their interests in the Butte Engineering & Electric Company and will conduct a manufacturers' agency business in the city, handling fixtures, lamps, heating appliances, electrical novelties and fixture glassware. Mr. Paul Butte and his brother will continue the business of the Butte Engineering & Electric Company.

SPRAGUE ELECTRIC COMPANY'S NEW ORLEANS OFFICE—Mr. A. W. Lewin has been advanced to the position of manager of the New Orleans office of the Sprague Electric Company, with which office Mr. Lewin has been connected for some time. He is a member of the American Institute of Electrical Engineers, and has had extensive commercial and engineering experience in the electrical business in both North and South America. This experience, combined with his command of the various languages spoken in his territory, promise a successful career in his new position.

THE RIDGWAY DYNAMO & ENGINE COMPANY announces the opening of a district office at No. 1311 Schofield Building, Cleveland, Ohio. Mr. H. C. Hale, who has been the Cleveland sales agent for Ridgway apparatus during the past two or three years, will be in charge of this office as local manager. Mr. Hale is well and favorably known in Cleveland as an able engineer and has been connected with several of its important engineering and manufacturing enterprises. While his experience has thus been varied, he has had special opportunities for observation and study of the many problems connected with the mechanical and electrical equipment of coal mines in the bituminous fields of Ohio, Pennsylvania, West Virginia and Kentucky. The Ridgway Dynamo & Engine Company supplies a large proportion of such power house equipment for the mines in these districts and considers itself fortunate in having Mr. Hale on its staff. He will be glad to have prospective purchasers of power plant machinery for any service confer with him in regard to their needs.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT 21, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector Street, N. Y. City.]

934,462. ELECTRIC MOTOR; A. A. Prevost, Mount Clemens, Mich. App. filed March 13, 1909. Direct-current motor in which the armature has radial poles divided into groups, each group comprising two like poles and an intermediate unlike pole.

934,463. CLEAT FOR ELECTRIC WIRES; W. F. Ritter, Cincinnati, Ohio. App. filed May 13, 1907. For supporting wires in open work on ceilings consisting of an elongated block with holes passing therethrough.

934,466. STARTING DEVICE FOR ELECTRIC MOTORS; H. M. Schiebe, Wilkinsburg, Pa. App. filed Sept. 9, 1907. Single-phase induction motor having an auxiliary winding for starting, which is cut out at a speed, and actuated by the cross-magnetizing flux produced in the primary core of the motor by the reaction of the secondary member at speed.

934,470. SYSTEM OF ELECTRIC MOTOR CONTROL; H. C. Soule, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Governs the speed of alternate-current motors by means of a transformer with two or more windings connected in multiple circuit, non-corresponding independent taps in each winding, constituting a series of substantially equal voltage steps and means for interconnecting the taps for producing steps other than those of the independent taps.

934,474. ELECTRIC CIRCUIT INTERRUPTER; H. R. Stuart, Wheeling, W. Va. App. filed July 9, 1906. A circuit interrupter having fluid containing tanks, stationary members in each tank, movable bridging members co-operating therewith, an insulating cross-bar connecting upright rods, which are attached to the bridging members and means for moving the cross-bar.

934,482. CIRCUIT BREAKER; C A. Tucker, Edgewood Park, Pa. App. filed Sept. 3, 1907. Circuit interrupter in which the movable members are held open and a starting spring tends to close them, and an electromagnet withdraws a latch which holds the movable member in a position of maximum separation and then supplements the action of the starting spring.

934,538. ELECTRICALLY HEATED SOLDERING MACHINE; M. H. Johnson, Utica, N. Y. App. filed June 1, 1908. A soldering machine with a rotary soldering iron carrying a cylindrical case, a heating coil in the case, collector rings on the end of the case and a base.

934,539. ELECTRICALLY HEATED SOLDERING IRON FOR CAN CAPPING MACHINES; M. H. Johnson, Utica, N. Y. App. filed Aug. 31, 1908. A soldering iron suspended from a frame and rotated by gears and having an internal electric-heating coil in a cavity at the lower end.

934,541. CLUSTER SOCKET; W. C. Jones, Chicago, Ill. App. filed Oct. 20, 1906. Insulating bushings of rubber or porcelain surround the threaded shells but do not extend through the openings in the casing so that the bushings do not interfere with the rotation of the casing.

934,542. CLUSTER LAMP SOCKET; W. C. Jones, Chicago, Ill. App. filed Oct. 20, 1906. A cluster lamp socket in which the structure after leaving the factory may be rearranged as to the circuit arrangement between the lamps. Makes use of a pair of conductor clamps for each socket element.

934,562. SUSPENDING DEVICE FOR TROLLEY WIRES; W. A. McCallum, Cincinnati, O. App. filed May 14, 1908. Includes a two-part ear, a compression ring for holding them clamped upon the trolley wire, a stem rotating in the ear and engaging an annual edge of the socket.

934,573. MAGNETIC ARC EXTINGUISHING MEANS; O. A. Sandborgh, Swissvale, Pa. App. filed Dec. 4, 1905. A plurality of independent switches with a magnetic blow-out located between adjacent switches.

934,596. ELECTRICAL SYSTEM; Frank Conrad, Swissvale, Pa. App. filed Sept. 3, 1907. For connecting electrical circuits in parallel. Provides a measuring instrument for giving the difference of voltage between the circuits.

934,628. AUTOMATIC PRISON SIGNAL; J. E. Rhoads and H. C. Fashbaugh, Canton, Ohio. App. filed May 10, 1909. Includes a grating with intercommunicating pipes supplied with compressed air and a signal valve connected therewith to control an electric circuit when the grating is broken.

934,631. RAILWAY SIGNAL; W. W. Salmon, Rochester, N. Y. App. filed June 3, 1909. A semaphore and spectacles adjustable with relation to each other and independently supported so that if the semaphore breaks the spectacles are operative, and if the spectacles break the semaphore remains operative.

934,670. JOINT FOR ELECTRICAL DEVICES; J. Keefe, Boston, Mass. App. filed Aug. 31, 1907. A joint having a coupling member to connect two conductors, a fixed fastener holding the coupling to the support and a screw extending into and engaging the hollow end of a stud for connecting one of the two conductors to the coupling member.

934,682. FLEXIBLE CONDUIT; G. A. Lutz, New York, N. Y. App. filed Aug. 21, 1907. A flexible conduit of fabric in spiral form with a spiral insulating lining within the tube and a spiral winding surrounding the tube, the edges of the winding coinciding.

934,711. SOLDERING DEVICE; F. S. Chapman, Kenton, Ohio. App. filed Oct. 16, 1908. A metallic tube with a coating of inflammable material on the outside of the tube and a lining of soldering material on the inside.

934,714. ELECTRIC CONDENSER; E. Denieport, Suresnes, France. App. filed May 23, 1908. A series of superimposed annular metal sheets, a metal sleeve extending within the sheets, a metal casing surrounding them, one set of alternate sheets connected with the sleeve, the remaining set with the casing.

934,754. REGULATOR FOR INCUBATORS; W. B. Porter, Aberdeen, Miss. App. filed March 5, 1908. A series of heat coils in a circuit arranged in the incubator with a second circuit for short circuiting one of the coils by means of a thermostat, which controls a circuit closer in the second circuit.

934,760. MEANS FOR LOCKING ELECTRIC LAMPS WITHIN THEIR HOLDERS; H. W. Roy and A. Weber, Wellington, New Zealand. App. filed June 7, 1909. To prevent stealing the lamps. Provides a band or collar encircling the holder, the ends of which are forced together by a key so as to firmly hold the lamp in place.

934,781. CALORIC CIRCUIT BREAKER; C. C. Woodworth, Portland, Ore. App. filed March 9, 1909. The expansion of a wire traversed by the main line current opens the main line and the arc is extinguished by a mica disk supported on a rocking arm.

934,796. ARC LAMP; H. E. Davies, Weehawken Heights, N. J. App. filed Oct. 1, 1907. The lamp has downwardly projecting electrodes, and their ends project into a chamber whose constricted size keeps it at a high temperature and retards the condensation of the vapors, thus increasing the life of the arc. The walls of the chamber are impregnated with a compound of a rare earth rendered incandescent by the arc.

934,808. CABLE HANGER; W. J. Hiss, Jr., New York, N. Y. App. filed Oct. 9, 1905. For supporting cables from guy wires by means of a wire clip bent upon itself to form a loop, the ends of the clip forming an eye and hook to receive the suspending cord.

934,811. MEANS FOR REDUCING THE REACTANCE OF ELECTRO-MAGNETIC DEVICES FOR TELEPHONE CIRCUITS; W. K. Howe, Rochester, N. Y. App. filed April 13, 1909. A tubular copper sheet surrounds the core of the magnet and a source of current energizes the magnet, the current being connected with the telephone circuit.

934,820. CONTROLLING APPARATUS FOR ELECTRICAL MACHINERY; L. Krieger, Colombes, France. App. filed Oct. 16, 1907. For electrical vehicles having an electric drive including a generator with a shunt winding and a series winding, of a demagnetizing winding of greater power opposed to the said series winding with means for short circuiting it.

934,839. IRON ELECTRODE; Max Roloff, Hagen, Germany. App. filed Oct. 28, 1904. Consists of magnetic oxide of iron magnetically derived from forge scale and free from non-magnetic ingredients of the scale.

934,854. PROCESS OF ELECTRICALLY WELDING METALS; Chas. R. Sturdevant, Worcester, Mass. App. filed April 1, 1909. Heats metal surfaces to be united by coating them with fusible material, placing an intermediate body of fusible material between them and passing a current therethrough.

934,865. MICROPHONE DESK STAND; A. H. Weiss, Chicago, Ill. App. filed Nov. 26, 1906. A microphone desk stand in which the weight of the telephone set controls the contacts by means of a reciprocating set-supporting rod which passes through the stand.

934,711.—Soldering Device.

934,874. FAULTFINDER; T. E. Anderson, Superior, Wis. App. filed Nov. 25, 1908. A portable device for finding faults in electric cables, in which a line of resistance wire is mounted in zig-zag relation on the support, has contact points suitable distances apart and a set of indicating numerals carried by the support adjacent to the contact points.

934,875. WIRELESS TELEGRAPH TRANSMITTER; C. D. Babcock, New York, N. Y.—App. filed June 11, 1908. Includes a transformer, a condenser, an impedance calibrated to wave lengths, a spark gap, a lever and a series of contacts corresponding to the calibrations over which the lever plays, the contacts jointed to the impedance. A scale shows the length of sparks.

934,878. FIRE ALARM ATTACHMENT; W. J. Bastedo, Flint, Mich. App. filed April 19, 1909. An attachment for fire alarm boxes acting as a safeguard against false alarms in which the detent mechanism is set for each booth and releases the booth door at about the time the fire apparatus would reach the booth in response to an alarm. The person operating the alarm is locked in until the officials are on the spot.

934,883. WIRELESS TELEGRAPHY; S. G. Brown, London, Eng. App. filed June 3, 1904. A sensitive receiver consisting of electrically deposited peroxide of lead.

934,895. RAILWAY TRAFFIC CONTROLLING DEVICE; F. L. Dodgson, Gates, N. Y. App. filed July 21, 1903. A railway switch operated by a motor with a controlling and indicating circuit.

934,896. SAFETY RELAY; F. L. Dodgson, Rochester, N. Y. App. filed Oct. 12, 1908. A relay which avoids fusing of the contacts acting to maintain a circuit. Automatic means produce and maintain a break in the circuit when the contacts are fused.

934,908. SELF-ANSWERING SIGNAL SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed Jan. 13, 1909. When the distant circuit is closed the operator is instantly notified by means of an electro-magnet which operates a circuit including a signal device.

934,920. CENTRIFUGAL SWITCH; C. L. Kennedy, Braintree, Mass. App. filed June 14, 1909. Opens or closes a circuit at a predctermined speed of a split-phase induction motor by means of two levers on a rotary support connected by parallel springs.

934,950. LOCKING ATTACHMENT FOR FUSE BOXES; W. R. Vanaman, Atlantic City, N. J. App. filed Feb. 26, 1909. For electric railway cars. A handle is connected with locking bolts so as to enable the box parts to be locked or unlocked.

934,973. RHEOSTAT; H. T. Jones, Bellevue, Pa. App. filed Oct. 19, 1908. A rheostat for a resistance which consists of a column of carbon disks having a sweep arm, an arc-shaped series of contacts and a connection between the block above the disks and the arm so that the arm compresses the column.

934,977. ELECTRICAL SIGNALING AND SWITCHING APPARATUS; R. H. Manson, Elyria, Ohio. App. filed Sept. 10, 1906. For a combined annunciator drop and jack. The electro-magnet has a frame with a spool carrying the winding supported in or on said frame and a spring latch detachably securing the parts together.

934,979. SELECTIVE DEVICE FOR PARTY LINE TELEPHONES; F. J. and J. Mersman, Ottawa, Ohio. App. filed May 29, 1907. A selective device for party lines including a magnet with a pivoted armature, a second armature, a ratchet wheel, a normally closed contact, the pivoted armature moving the ratchet wheel when the magnet is energized by low voltage and the second armature breaking the contact when the magnet is energized by a high-voltage current.